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Volume 16 Number 1 March 1980

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NEWS & NOTES

EDITORS NOTE: Due to difficulties beyond our control, we have changed printers. Our format had to change as reflected with this issue. We hope for your continued support.

HSH

The Maryland Herpetological Society
Department of Herpetology
Natural History Society of Maryland, Inc.
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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 16 31 MARCH 1980 NUMER 1

HERPETOLOGICAL SURVEY OF THE ELMS SITE, ST. MARY'S COUNTY, MARYLAND

Marie Van Deusen and Robert H. Johnson

A field survey of the reptiles and amphibians inhabiting the Elms Property in St. Mary's County, Maryland was conducted from May 1978 through March 1979. This property is part of the Maryland Power Plant Siting Program land bank of potential future power plant sites. The herpetological survey was part of a larger, preliminary ecological evaluation of the site (Van Deusen *et al.* 1979). The purpose of the survey was to provide general information on species present, their relative abundances and habitat preferences.

The Elms Property consists of approximately 990 acres (402 ha) bordering the western shore of the Chesapeake Bay, six miles southeast of Lexington Park (Figure 1). The eastern two-thirds of the property is lowland plain dissected by several marshes and ponds. This plain rises to about 40 feet above mean sea level (MSL) and is separated from the upland plateau (~110 ft. above MSL) by a ridge rising 60 feet in elevation over about 0.1 mi. Habitats onsite include several ponds ranging from <1 to ~13 acres, brackish marsh, shrub swamp, fields managed for wildlife and several types of coastal plain forest.

Methods

Our field survey began with a thorough foot search of the entire Elms tract aimed at locating particularly likely habitats for herptiles. Once these were identified, we actively searched the selected habitats on subsequent visits, and only cursorily explored other areas. Field collections were made by turning over logs, stones and other surface debris, raking through leaf litter, removing bark from dead trees and logs, digging, picking through rotted lots and searching low-hanging branches, tree trunks and basking sites. Dipnets and waders were used in aquatic habitats.

Animals were identified primarily by visual inspection of adults and larvae and eggs in season with the aid of Conant (1975). Many frogs and toads were identifiable by voice, especially during breeding season.

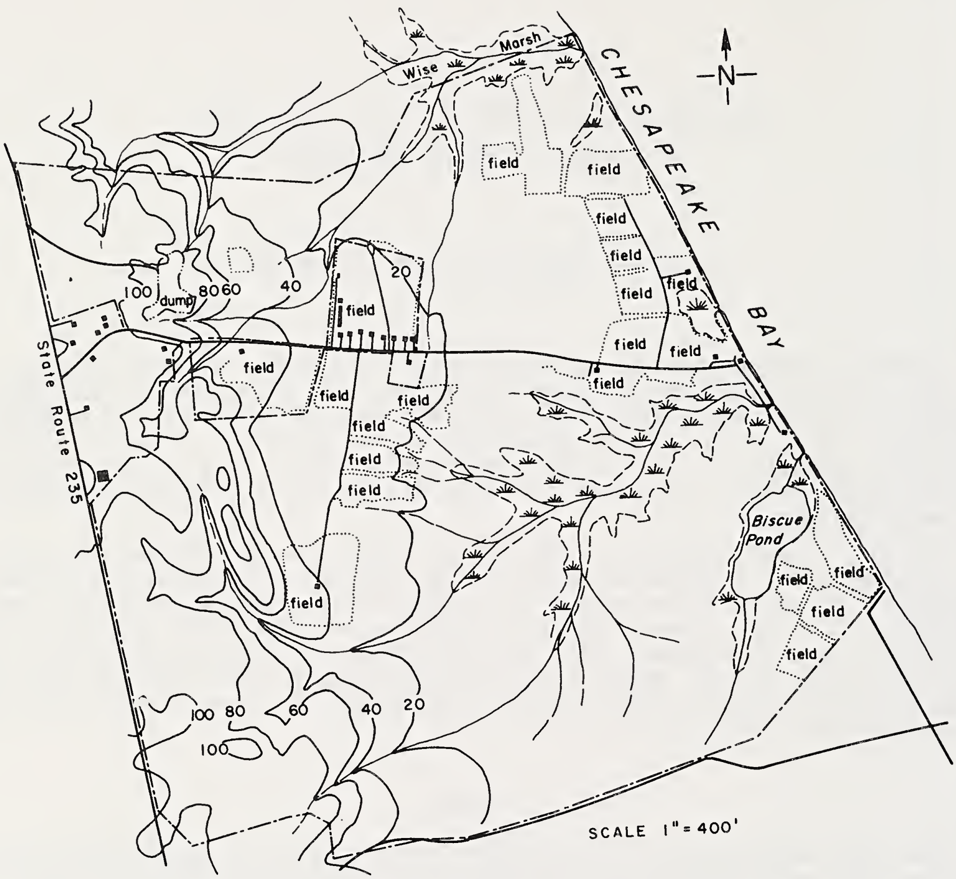

Fig. 1. Map of the Elms Property, St. Mary's County, Maryland

Results and Discussion

Amphibians: Seven species of salamanders, 2 toad species and 9 species of frogs were observed (Table 1). This represents ~86% (18/21) of the amphibians known to occur in St. Mary's County (Harris 1975). Relative abundances are also given (Table 1):

Abundant - found in large numbers

Common - found in fairly large numbers and/or frequently encountered

Uncommon - found in small numbers and/or infrequently encountered

Rare - single sightings

These estimates of abundance are based on our field observations; however, in several cases, we felt our observations erroneously estimated abundances because of marked seasonality, specific habitat affinities or cryptic nature of indivisual species. For example, spadefoot toad and pickerel frog were uncommon by our observations, but probably are common on the site; certainly there is a profusion of appropriate habitat.

Several species of amphibians deserve special mention. The spotted salamander (*Ambystoma maculatum)* was never encountered as an adult, although hundreds of egg masses were found during a mid-March trip, occupying virtually every available body of water on and near the site. Of all the red-backed salamanders *(Plethodon c. cinereus)* encountered, only one was in the red-backed phase, the rest being lead-backed. Fowler's toads *(Bufo woodhousei fowleri)* were found everywhere on the site and on every visit. *Acris* and the three *Hyla* species were heard in great numbers and seen in every pond, marsh, pool and stream in the area; their abundances appeared to be quite high.

Absence of marbled salamanders *(Ambystoma opacum)* from the site is surprising as there appears to be ample adult and breeding habitat, and they frequently use the same ponds as their congeners *(A. maculatum)*, which were abundant. The red-spotted newt *(Notophthalmus v. viridescens)* has been reported from only the northern part of St. Mary's County (Harris 1975); permanent wooded ponds necessary for breeding are absent from the site. The eastern narrow-mouthed toad *(Gastrophryne carolinensis)* was of special interest because of its endangered status in Maryland (Maryland Non-Game and Endangered Species Conservation Act of 1975). We did not find any specimens of this small and inconspicuous anuran, whose habitat requirements are not well-known (Conant 1975). This toad has been reported from an area west of the Elms and its absence from the site cannot be presumed.

Reptiles. Among the reptiles, we found 4 lizards, 10 snakes and 4 turtles during the Elms survey (Table 2), which represent ~58% (18/31) of the reptiles occurring in St. Mary's County (Harris 1975). Relative abundances were designated as for amphibians, with the same caveats, *e.g.*, eastern worm snake, eastern ribbon snake and spotted turtle were all uncommon by our observations, but have ample suitable habitat. All four lizard species were infrequently encountered, but are probably common to abundant.

Eastern box turtle *(Terrapene c. carolina)* was found nearly everywhere on the site and on every visit. Northern water snakes, black racers and black rat snakes were particularly abundant, as were mud turtles.

Several species generally regarded as common were absent from our survey: eastern hognose snake *(Heterodon platyrhinos)*, coastal plain milksnake *(Lampropeltis triangulum temporalis)*, eastern garter snake *(Thamnophis s. sirtalis)*, common snapping turtle *(Chelydra s. serpentina)* and eastern painted turtle *(Chrysemys p. picta)*. These snakes are habitat generalists and probably present. The turtles are common species of swamp and marsh, which are abundant on the site.

Table 1. Amphibians of the Elms, St. Mary's County, May 1978 to March 1979. (Taxonomy from Conant 1975)

Order (O.) Family (F.) Species	Common Name	Relative Abundance	Habitat
O. Caudata			
F. Ambystomatidae			
Ambystoma maculatum	Spotted salamander	Abundant	Moist woods-aquatic breeders - even marsh and ruts
F. Plethodontidae			
Desmognathus f. fuscus	Northern dusky salamander	Common	Seeps and streams
Plethodon c. cinereus	Red-backed salamander	Abundant	Moist woods, under detritus
Hemidactylium scutatum	Four-toed salamander	Common	Periodically inundated woods, sphagnum bogs; aquatic breeders
Pseudotriton m. montanus	Eastern mud salamander	Rare	Muddy seeps
Pseudotriton r. ruber	Northern red salamander	Uncommon	Moist forests, streams edges
Eurycea b. bislineata	Northern two-lined salamander	Abundant	Seeps and streams
O. Anura			
F. Pelobatidae			
Scaphiopus h. holbrooki	Eastern spadefoot toad	Uncommon	Wet woods, but also xeric - adapted
F. Bufonidae			
Bufo woodhousei fowleri	Fowler's toad	Abundant	Ubiquitous

Table 1. (continued)

Order (O.) Family (F.) Species	Common Name	Relative Abundance	Habitat
F. Hylidae			
Acris c. crepitans	Northern cricket frog	Abundant seasonally	All water bodies
Hyla crucifer	Spring peeper	Abundant seasonally	Marshes
Hyla cinerea	Green treefrog	Abundant seasonally	Marshes
Hyla chrysoscelis	Southern grey treefrog	Common seasonally	Marshes
Pseudacris triseriata feriarum	Upland chorus frog	Common seasonally	Low moist woods
F. Ranidae			
Rana catesbeiana	Bullfrog	Common	All marshes and Biscue
Rana clamitans melanota	Green frog	Abundant	Ubiquitous except extreme uplands
Rana u. utricularia	Southern leopard frog	Abundant	Ubiquitous except extreme uplands
Rana palustris	Pickerel frog	Uncommon	Field and woods

Table 2. Reptiles of the Elms, St. Mary's County, May 1978 to March 1979 (Taxonomy from Conant 1975)

Order (O.) Family (F.) Species	Common Name	Relative Abundance	Habitat
O. Squamata			
F. Iguanidae			
Sceloporus undulatus hyacinthinus	Northern fence lizard	Uncommon	Open woods and fields
F. Teiidae			
Cnemidophorus s. sexlineatus	Six-lined racerunner	Uncommon	Scrub vegatation on berm; habitat generalists
F. Scincidae			
Leiolopisma laterale	Ground skink	Uncommon	Woody detritus
Eumeces fasciatus	Five-lined skink	Uncommon	Damp woods, woody debris
F. Colubridae			
Natrix s. sipedon	Northern water snake	Abundant	Marsh and pond
Storeria d. dekayi	Northern brown snake	Common	Any moist area frequently in rotting wood
Thamnophis s. sauritus	Eastern ribbon snake	Uncommon	Semiaquatic
Diadophis punctatus edwardsi	Northern ringneck snake	Common	Woods, open areas with abundant debris for refugia
Carphophis a. amoenus	Eastern worm snake	Uncommon	Damp substrates, borrows
Coluber c. constrictor	Northern black racer	Abundant	Ubiquitous

Table 2. (continued)

Order (O.) Family (F.) Species	Common Name	Relative Abundance	Habitat
F. Colubridae (cont'd)			
Opheodrys aestivus	Rough green snake	Common	Cut-over fields, edge
Elaphe o. obsoleta	Black rat snake	Abundant	Ubiquitous
Lampropeltis g. getulus	Eastern kingsnake	Uncommon	Fields, woods, stream edges
F. Viperidae			
Agkistrodon contortrix mokasen	Northern copperhead	Uncommon	Rocky, wooded areas, somewhat xeric
O. Testudines			
F. Kinosternidae			
Kinosternon s. subrubrum	Eastern mud turtle	Abundant	Marshes, pools, muddy roadsides
F. Emydidae			
Clemmys guttata	Spotted turtle	Uncommon	Shrub swamp
Terrapene c. carolina	Eastern box turtle	Abundant	Ubiquitous except in water
Malaclemys t. terrapin	Northern diamond-back terrapin	Rare	Marsh and pond, brackish water

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HERPETOFAUNA OF THE PEDREGAL DE SAN ANGEL, D.F., MEXICO

Oscar Sánchez-Herrera

ABSTRACT

The herpetofauna of the Pedregal de San Angel, D.F., Mexico, now endangered by man's activities, is summarized for the first time. New records for this locality, amphibians among them, are included together with some notes on the Natural History and Ecology of the species occurring here.

The Pedregal de San Angel area, adjacent to Mexico City, in spite of its close proximity to the urban complex and its accessibility, has not yet been thoroughly investigated from the zoological point of view, although other biological aspects have received some attention.

Rzedowski (1954) defines the Pedregal de San Angel as all the lava field descending from the nearby Xitle volcano to the south and southwest of Mexico City. In the present study, it will be restricted to the vegetational community named by Rzedowski himself "Senecionetum praecocis" in reference to the dominant plant species (*Senecio praecox*, Compositae). This association can be found up to 2500 m above sea level.

He characterizes the area as "Open heath with an heterogeneous structure, presenting great differences in its floristic composition. The arbustive, herbaceous and grazing strata are well represented, but the true arboreal stratum is absent". The annual mean temperature ranges from 14 to 15°C.

Diaz (1961) recognized some of the most conspicuous reptilian species in the locality; three saurians (Iguanidae: two *Sceloporus* and one *Phrynosoma*) and three snakes (Colubridae: *Pituophis* and *Salvadora*, and Crotalidae: *Crotalus*). She does not mention amphibians, and unfortunately, does not present direct data on the Natural History of the recorded species. Duellman (1970) cites a specimen of *Hyla arenicolor* from this locality, but does not discuss it.

Field work by the author and some associates between 1973 and 1978, as well as review of other previously collected material, have revealed the presence of additional species in the area.

Presently, the herpetofaunal list of the Pedregal de San Angel can be summarized as follows, with new records marked by an asterisk:

AMPHIBIA

Order Caudata

PLETHODONTIDAE

Pseudoeurycea cephalica cephalica (Cope) *

Order Salientia

LEPTODACTYLIDAE

Tomodactylus angustidigitorum Taylor *

HYLIDAE

Hyla arenicolor Cope

REPTILIA

Suborder Sauria

IGUANIDAE

Phrynosoma orbiculare orbiculare (Linnaeus)

Sceloporus grammicus microlepidotus Wiegmann

Sceloporus torquatus torquatus Wiegmann

Suborder Serpentes

COLUBRIDAE

Diadophis punctatus dugesi Villada *

Pituophis deppei deppei (Dumeril)

Rhadinaea laureata (Günther) *

Salvadora bairdi Jan

Thamnophis dorsalis cyclides Cope *

Toluca lineata lineata Kennicot *

CROTALIDAE

Crotalus molossus nigrescens Gloyd

It is not unlikely that additional field work, especially at night, when many species are active, could increase the number of species recorded. The rugged terrain makes it difficult to search for specimens in the numerous crevices by day.

Account of Species

The greatest part of the material examined belongs to the Herpetological Collection of the Instituto de Biologia de la Universidad Nacional Autónoma de México (IBH), other specimens are deposited in the author's collection (OSH) and one in the collection of the Facultad de Ciencias, U.N.A.M. (LIHFC).

Measurements were taken to the nearest tenth-millimeter; the letters SVL are for snout-to-vent length. The data on the Natural History were obtained from direct observation in the field as well as in captivity.

Pseudoeurycea cephalica cephalica

One subadult female (IBH01023), collected 12 October 1976, measures 36.9 mm SVL and 28 mm tail length

The tips of the toes and fingers in maximal approximation are separated by four costal folds. This specimen has whitish flecks on the venter, closely resembling in this aspect *Pseudoeurycea cephalica manni* as described by Smith and Taylor (1948); but it is here assigned to *P. c. cephalica* based on geographical considerations. It was collected by day (1100 hrs) among leaf litter and pebbles clustered near the base of a "palo. loco" (*Senecio praecox*).

This species has frequently been collected in nearby localities such as the Ajusco mountains and the lakes of Cempoala; but in these higher areas, the vegetation is mainly coniferous forest and the area has a different climatic regime, especially in relation to humidity. Thus, *P. c. cephalica* seems to be a more eurytopic (Udvardy, 1969) salamander than has been formerly thought.

Tomodactylus angustidigitorum

One adult male (OSH0107), collected 13 June 1977, measures 28.6 mm SVL, tibia 11.4 mm and tympanum 1.7 mm.

The two outer digits are neither truncate nor widened at the tip. Following Taylor (1939), the specimen has been determined to be *angustidigitorum*. Some coloration features (in life) include sparse dorsal pustules with a light apex, a dark canthal stripe extending to the insertion of arm, a light loreal surface continued to the tympanum, a bi-colored iris, the upper half of eye being golden bronze with dark reticulations, and the lower half dark brown.

The specimen was collected at night (1900 hrs) just after the first heavy rain, and seems to be the first reported from this physiographic area.

Many of these toads were calling, and several of them were discovered by our lights while perched on top of rocks, as described by Davis and Smith (1953) for *Tomodactylus nitidus* and *T. fuscus* in warmer areas in the State of Morelos. The voice of this species is a single whistling, abruptly initiated and terminated, its intensity and tone remaining seemingly constant during the emission. This call lasts for almost a second and is followed by a silence of 4 to 6 seconds.

The extreme drought of several months during the year at San Angel could not be an obstacle for the reproduction of these toads if they share the direct developmental pattern recorded by Martin del Campo (1940) for *T. nitidus* from Tres Cruces, Morelos.

In relation to the species to which Martin del Campo's account refers; I believe that it is probably *T. fuscus* not *nitidus*, since Tres Cruces (Tres Cumbres) is not far from Huitzilac, near the type of locality of *fuscus* (Davis and Dixon, 1955). *T. nitidus* generally inhabits lower regions.

Hyla arenicolor

Two young individuals, females, IBH01777 and IBH01777-2, collected by Biol. Alberto Gonzalez R. on 29 August 1977. Another specimen (uncatalogued) is from LIHFC.

Measurements:

No.	SVL, mm	tibia, mm	tail, mm	tympanum, mm
IBH01777	20.4	10.9	reabsorbed	1.1
IBH01777-2	19.6	9.0	2	not apparent
LIHFC	45.0	24.0	---	2.1

The presence of *Hyla arenicolor* in the Pedregal was only known from one specimen in the collection of the Instituto Politecnico Nacional in Mexico City, as noted by Duellman (1970), but it is probably more common than records indicate. A sight record by the author in August 1973 (an adult observed in full activity in the evening, after a moderately intense rain) indicates crepuscular habits.

Duellman (op. cit.) states that "... In the mountains rising from and bordering the Mexican Plateau, this species occurs in pine and oak forest, and in the lower slopes of the highlands the frog occurs in scrub oak and dense thorn forest. However, throughout its range it is always closely associated with small rocky streams; *Hyla arenicolor* inhabits ravines and canyons."

The occurrence of *Hyla arenicolor* in our lava field is interesting since in the Pedregal there are no permanent water courses or temporary ones. There are also no canyons in the vicinity.

The great majority of the species of *Hyla* inhabiting temperate areas in Mexico need water to lay their eggs; but surface streams are lacking in the natural areas of the Pedregal, so the frogs must have another aquatic medium in which to lay the eggs. The seasonal accumulations of rainwater into the rock crevices could provide such a microhabitat, but the porous basalt tends to percolate this water, and thus the development of the young tadpoles must adapt to the short duration of these "ponds".

Zweifel (1961) afforded interesting data on the reproduction of the species. He records oviposition between 12-13 July and a span of 50-60 days for larval development. The newly metamorphosed individuals having a snout-vent length of nearly 15 mm.

The specimens from the Pedregal enhance the evidence for oviposition between June and July, but the smallest of the two young has a 19.6 mm SVL, plus 2 mm of still unabsorbed tail, as well as a poorly developed tympanum. These data differ from Zweifel's, but the wide distribution of the species could account for a greater intraspecific variability than expected.

Phrynosoma orbiculare orbiculare

Two specimens, females, IBH00781 and IBH 00782, collected in June 1959.

Apparently, this species has been dramatically reduced in numbers in the last several years. Since 1973 no additional individuals have been recorded from the area. This seems to be related to the accelerated rate of urban expansion, which increases the human interaction with this species (i.e. collecting, in order to keep the animals as children's pets). Due to the scarcity of material, I do not attempt to discuss its Natural History.

Sceloporus torquatus torquatus
Three males, IBH 00251, IBH00927 and OSH0130; three females, OSH0127 to OSH0129.

These lizards are the most conspicuous element of the local herpetofauna. A few of their main ethological and reproductive features can be indicated.

They spend the early hours of the day basking on the rocks until they become fully active, displaying territorial behavior.

During the rainy season, they are frequently observed climbing among the branches of the tepozan plants (*Buddleia americana*, Loganiaceae) or the palo loco (*S. praecox*) where they pursue the insects attracted by the inflorescences.

Newly born individuals have been recorded in May and June, and the observed clutch sizes range from 4 to 6 young.

Sceloporus grammicus microlepidotus
One male, IBH00898 collected on 6 May 1965, and 15 uncatalogued specimens in OSH; 6 males and 9 females collected throughout the year.

These lizards are common in the periphery of the area, and they are active through all seasons; unlike *S. t. torquatus*, which in the colder months is hardly detectable.

S. g. microlepidotus, in other localities, is frequently found active on the trunks of live trees; while in the Pedregal, due to the scarcity of suitable perches, the species utilizes some areas where the rocks covered by bushes offer adequate protection. However, if any trees are present, such as pirules (*Schinus molle*, Anacardiaceae) or eucalyptus (*Eucalyptus globulus*, Myrtaceae) the lizards will make use of them preferentially. The fact that both of these trees are introduced, and are spreading, indicates the possibility of this lizard spreading into areas of the lava not yet colonized by them.

Diadophis punctatus dugesi
One male, IBH00949, collected in a Campus building in February 1970.

This specimen agrees well with *dugesi*, and its general scutellation follows: 17 dorsal rows, 179 ventrals, 60 subcaudals.

Measurements were not recorded due to the poor condition of the specimen available.

It seems to be a rather uncommon snake in the study area, or at least an inconspicuous one. Nevertheless, an observation in June 1975, appears to indicate crepuscular or nocturnal habits.

In captivity one *D. p. dugesi* consumed a ground snake (*Toluca lineata lineata*) at night, while during the day it showed no interest in it.

Besides the typical defensive attitude of this genus (coiling up the tail above soil and showing the red-orange color of the underside) *dugesi* exhibits abundant salivation when roughly handled. The reasons for this behavioral trend, observed in several released individuals, are not clear but it is also evident when the snakes are swallowing prey.

Pituophis deppei deppei

Two females, IBH00735 and IBH 00982; and eight males, IBH00736-738, IBH00866, IBH00892, IBH00979 and IBH00983.

All the specimens can be readily assigned to *P. d. deppei* as defined by Smith and Taylor (1945). Very little is known about its local ecology and habits, except that they are extremely wary.

Rhadinaea laureata

Two specimens: IBH00985, male, collected 20 July 1976 (field no. OSH0056) and another whose label reads only "Pedregal de San Angel" (IBH00986).

The general squamation follows:

nos.	dorsal rows	ventrals	subcaudals
IBH00985	17	155	91
IBH00986	17	160	96

This snake had been recorded from the vicinity, but always in ecologically different areas.

Myers (1974) in his careful revision of the genus gives no data on the natural history of the species. The male collected in July was found near a rock in the evening. Another caged juvenile snake showed signs of activity only near the end of daylight.

R. laureata kept in the laboratory refused all food except small frogs (*Hyla picta*); thus, in the study area it probably preys on *Hyla arenicolor* and/or *Tomodactylus angustidigitorum*.

Salvadora bairdi

Four males (IBH00786, IBH00931, IBH00972 and IBH1078) and one female: IBH00776.

These snakes are not commonly seen, although they must be abundant. In adjacent localities, lizards comprise the main food for this snake, but in captivity some specimens readily accepted newly born laboratory mice. In the Pedregal, *Sceloporus t. torquatus* is likely to be the selected prey species owing to its abundance. *Salvadora bairdi* is diurnal in habits, and I have recorded these snakes actively chasing lizards and devouring them while still alive.

Thamnophis dorsalis cyclides

One specimen, OSH0126, male, collected 14 August 1976. This snake measured 570 mm total length, 156 mm tail length and had dorsal scale rows of 19-19-17, 164 ventrals and 94 subcaudals.

Some problems still exist concerning the identification of some Mexican *Thamnophis*, particularly those in the *dorsalis* group. Thus several populations can not be referred with certainty to any subspecific entity. In the present case, considering Smith (1942 and 1951), Smith and Taylor (1945), Conant (1963) and Smith and Smith (1976), this specimen has been tentatively identified as *T. d. cyclides* Cope.

The snake was collected in a vertical crevice on a cloudy, rainy afternoon. It readily crawled into the crevice when discovered. The activity patterns of these snakes and their amphibian prey may well coincide, but data are scarce indicating only similar hours of activity for *Hyla* and *Thamnophis*.

Toluca lineata lineata

Two specimens: OSH0418, female; and OSH0419, male, collected 26 June 1978.

These fossorial snakes are rather common in the neighborhood of Mexico City, though in the Pedregal they have been collected only in empty lots to which the basalt extends.

They are only conspicuous during the rainy months, when they hide under loose stones which they leave at night to go in search of prey (mainly orthopterans and some coleopteran larvae).

T. lineata never attempts to bite; at most it coils up into a ball around one's fingers or tries to escape.

Crotalus molossus nigrescens

Four males, IBH00745, IBH00747, IBH00748, OSH0105; and four females, IBH00742, IBH00743 and IBH00844.

These rattlesnakes are fairly common in the area and can be encountered roughly from March to October. They are not especially agressive, and usually retreat into hiding at the slightest indication of danger.

One stomach (of OSH0105) contained the remains of *Rattus rattus*, the common rat. Due to the size of newly born and adult snakes of this species (about 300 and 900 mm respectively) it seems likely that many other mammals in the area could serve as suitable prey. Among the most probably we can include the following (pers. comm. M.S. William Lopez-Forment C.): *Baiomys musculus*, *Microtus mexicanus*, *Mus musculus*, *Neotoma mexicana*, *Peromyscus boylii*, *Peromyscus maniculatus*, *Peromyscus truei*, *Reithrodontomys megalotis*, *Spermophilus mexicanus*, *Spermophilus variegatus*, and *Sylvilagus floridanus*.

The mammalian predators are comparatively scarce in the Pedregal, including skunks (*Spilogale*, *Mephitis* and *Conepatus*) and opossums (*Didelphis*). The only avian predators are the barn owls (*Tyto alba pratincola*) and occasionally a red tailed hawk (*Buteo jamaicensis*). Thus, the *Crotalus* and *Pituophis* must be responsible for much of the predation on small mammals in this ecosystem.

The habitacula of *C. m. nigrescens* frequently include horizontal crannies under basaltic plates, which on a sunny day readily warm up as to permit the snakes to become active thigmothermically. Nevertheless, some individuals can be found basking in direct sunlight.

On 24 June 1973 an adult female gave birth to six young whose total lengths at birth ranged between 270 and 310 mm ($\bar{X}$ = 290.8), three more were born dead. The young snakes increased in length between 10 and 40 mm in two months. Six years after its birth, one of these snakes has attained a length of 870 mm. Other gravid females have been recorded on 13 June 1977, as almost ready to give birth. All the snakes born in 1973 shed the skin for the first time one week after birth, and shortly after, they began to eat suckling albino mice. On the contrary, rattlesnakes collected as adults or as juveniles in the field, seldom are white mice, but quickly accepted wild *Mus* and *Microtus*; still others completely refused food.

Conslusions

The Pedregal de San Angel is a good example of how some apparently well known areas can harbor several additional species than those previously recorded.

Some of the species recorded in this paper are present in many locations in the vicinity of Mexico City, but others such as *Thamnophis dorsalis* and *Hyla arenicolor* seem to be restricted to the biotic community of the Pedregal.

Among the herpetological species of the area, only *Crotalus molossus* could represent some potential danger to the nearby human population, but the only two known cases of envenomation were produced by irresponsible handling of the snakes.

C. molossus exists in its local habitat, away from man, and has no important interactions with him, except for the help it offers devouring rodents.

Oppositely, some species tend to be more or less anthropophilous, *Sceloporus grammicus* colonizing even fences and trees in house gardens and *Toluca lineata* inhabitating idle ground in the city.

The near future is all that is left to attempt ecological studies on this interesting herpetofauna; so close to one of the greatest urban concentrations on Earth, and threatened by the unrestricted growth of this human aggregation; which carries forward an ever increasing alteration of the environment.

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PREY-INDUCED CAUDAL MOVEMENTS IN BOA CONSTRICTOR WITH COMMENTS ON THE EVOLUTION OF CAUDAL LURING

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ABSTRACT

Two specimens of *Boa constrictor occidentalis* were observed to emit caudal movements during feeding episodes. When the prey (a mouse) wandered out of the predators' sight, all forward movement by the snakes ceased and worm-like wriggling movements of the snakes' tails were seen. It is possible that certain kinds of prey (esp., birds and lizards) might be attracted to such movements. Accordingly these movements are hypothesized to represent a primitive type of caudal luring. It is further hypothesized that caudal movements evolved as a displacement response engendered by a conflict or thwarting situation that characterizes predators relying on ambush tactics. That is, the initial sight of prey probably arouses a strong tendency to attack which must be inhibited until the prey enters striking range; premature movement might frighten the prey. Caudal movements might provide a behavorial outlet for the impulse to attack while at the same time inhibiting all gross movements of the predators' anterior parts. The fact that caudal movement can lure certain prey provides the selective pressure for the ritualization of this displacement response.

Heatwole and Dawson (1976) reviewed caudal luring and defined it as the wriggling or waving of a conspicuous tail, by an otherwise cryptically marked snake, which serves to attract prey within striking range. Caudal luring has been described in very few species of non-crotaline snakes. Two vipers, *Cerastes vipera* (Heatwole & Dawson, 1976) and *Vipera russelli* (Henderson, 1970) have been reported to lure, as has the viper-like elapid, *Acanthophis antarcticus* (Carpenter, Murphy, & Carpenter, 1978). With the exception of *Cerastes vipera* and *Bothrops bilineatus* (Green & Campbell, 1972) caudal luring has been limited to juvenile snakes. Neil (1960) suggested, strictly on the basis of caudal coloration, that caudal luring may occur in some juvenile boids, but no behavior observations were reported. Murphy, Carperter, and Gillingham (1978) observed caudal luring in juvenile *Chondropython viridis* when anoles were visible to the snakes. The authors here report some unusual tail movements in *Boa constrictor occidentalis* that may be interpreted as a primitive state of luring behavior.

Two juvenile *Boa constrictor occidentalis* were acquired in November 1977, when they were probably less than three months of age. The snakes were maintained in 38 liter reptile tanks (with sliding aluminum tops) at a daytime temperature of 29-32° C

and a night temperature of 24-27° C. They were fed one small mouse at weekly intervals. The high temperatures and small feedings kept the snakes extremely hungry as evidenced by their general alertness, orientation toward movement, and readiness to feed.

Both snakes responded to the sight of food with wriggling tail movements on at least four occasions but could not always be induced to wriggle the tail under stimulus conditions that were seemingly identical to those which presumably caused the reactions on other occasions. The tail movements were quite wormlike, and they were enhanced by the fact that the tails were marked somewhat more vividly than the body with narrow yellowish brown lines outlining dark brown saddles. The movement of the tail might be described as irregular sine waves originating in the proximal portion of the tail and moving distally. The amount of the tail involved varied with the intensity of the wriggling movements.

The actual sequence in which the behavior occurred was somewhat unusual, in the sense that the tail movements most often occurred when the prey moved out of the snakes' line of sight. Upon the introduction of a live mouse into a snake's cage, the snake would very slowly start to crawl toward the mouse, keeping the head and neck in an S-shaped striking position. At this point if the mouse went behind a rock or stopped moving at some distance from the snake, the boa would initiate the tail movements and stop all movement in the rest of the body. When the mouse became visible again the snake would begin advancing and stop moving the tail. This same sequence was induced twice by just moving a finger along the bottom of the glass front of the aquarium. The snake would start to approach and then stop and begin the stereotyped tail movement when the movement of the finger ceased.

Although not as well developed as the elaborate luring behavior in *Acanthopis* or *Agkistrodon bilineatus*, we believe that even these primitive tail movements could be useful as a caudal lure and that they are a normal, if not invariable, part of the feeding sequence for the following reasons:

1. The movements were quite worm-like and might attract a lizard or small bird which even these juveniles could eat. (An adult *B. c. occidentalis* in the first author's collection fed exclusively on birds.) Even though these tail movements seem to occur much more frequently when the prey has left the field of vision of the snake, they could still be effective in attracting the prey back into striking range.

2. The tail movements were easier to elicit when the snakes were hungry and very difficult to elicit when they had been recently fed, suggesting that the motivational state of the snake was a critical factor.

3. The behavior was elicited by the sight of mice or by hand movements near the cage which may have been interpreted as prey; but the behavior was never elicited by disturbing the snake in ways that were clearly not prey related (e.g., cage cleaning, replacing water).

Perhaps more important than the question of the effectiveness of these tail movements as a lure, is the fact that these rather primitive and, seemingly poorly timed movements may be representative of the first step in the phylogenetic events leading to the elaborate caudal luring seen in other species. The occurrence of this behavior almost exclusively just after the prey has gone out of sight suggests very strongly that the behavior arose as a displacement activity.

We postulate that when the boa sees the prey, neurological and physiological reactions occur (e.g., hyperventilation and tachycardia) which prepare the snake to attack. The snake moves toward the prey and suddenly the external stimulus, sight of the prey, is no longer present; however, the internal preparations for attack have been set in motion and these may predispose the snake to go through the entire feeding sequence (Chiszar, Radcliffe & Scudder, 1977; Chiszar, Radcliffe & Smith, 1978). The snake is now getting two conflicting behavorial signals. Internally, it is prepared to attack, while externally the stimulus for that attack has been removed. What occurs is the irrelevant behavior of tail wriggling which we believe may be a displacement activity. The relevant behavior in this case might be for the snake to move toward the spot where the prey was last seen and begin chemosensory searching; however, with active alert prey like lizards, birds or rodents this would be more likely to frighten the prey away than to yield a meal. The tail wriggling then could be a behavioral outlet for the preparations to attack and may inhibit searching movements that would likely be wasteful of energy and frightening to prey. A perhaps analogous situation occurs in crotalids where chemosensory searching is not released by sight or smell of the prey, but only by striking which would render the prey incapable of escaping (Chiszar et al., 1977, 1978, and Chiszar, Simonsen, Radcliffe & Smith, 1979).

One of the first evolutionary steps away from active-search hunting tactics and toward ambush hunting tactics must have been the inhibition of the tendency to move toward the prey when it is first spotted. This inhibition of a powerful attack motivation would result in a conflict or thwarting situation which could result in a displacement activity.

Caudal luring behavior seems to be limited to species that would be described as ambush predators as opposed to active search predators. This is consistent with the idea that the need to inhibit the attack provides the conflict situation which can produce a displacement activity.

We believe that this explanation of the origin of tail-wriggling movements as a behavioral consequence of the conflict situation involved with ambush hunting is more parsimonious than assuming that caudal luring was evolved "de novo" at least three times, in the elapids, the crotalids (including viperine), and in the boids.

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ADDITIONS TO AND NOTES ON THE KNOWN SNAKE FAUNA OF THE ESTACIÓN DE BIOLOGÍA TROPICAL "LOS TUXTLAS", VERACRUZ, MÉXICO

Gonzalo Pérez-Higareda

The herpetofauna of the Estación de Biología Tropical "Los Tuxtlas" was recently summarized as it had been sampled over a period of more than a year of intensive survey (Pérez-Higareda, 1978). To the list there given of 31 species of snakes known to occur at the Estación, six additional species may now be recorded.

Typhlops tenuis Salvin

One specimen captured in August 1979, has the characteristics noted by Smith and Taylor (1945): preocular separated from anterior section of nasal by contact of posterior (upper) section with second labial, no subocular, and 18 scale rows.

Leptotyphlops goudoti phenops (Cope)

One speciman captured in July 1979, exhibits the normal characteristics of the subspecies: dorsal pattern dark brown in life, with longitudinal lines and the supraocular much larger than prefrontal; rostral not contacting supraocular. Total length 110 mm.

Amastridium veliferum sapperi (Werner)

The specimen is a female, taken by the Biologist Enrique González S., in November 1978, and presents the following characteristics: 17-17-17 scale rows, 152 ventrals, 77 caudals, 6-6 supralabials, 8-8 infralabials, 1-1 loreals; coloration black dorsally and ventrally; top of head orange, frontals and parietals spotted with black and white; two yellow scales on each side of nape (posttemporal region); 3rd and 4th supralabials entering orbit; total length 370 mm (270 s-v, tail 100). The specimen was found on a humid tree trunk. The stomach contained a number of small myriapods.

The specimen here described conforms in all particulars with the northern populations of the species to which Smith (1971) suggested that the subspecies named *sapperi* be applied, based largely upon the data supplied by Wilson and Meyer (1969). Most importantly, the loreal is present and the ventrals are numerous, falling well within the previously recorded range for females (144-170) of the subspecies.

Coniophanes fissidens fissidens (Günther)

This subspecies was not mentioned in my previous list (*op.cit.*); in that work I reported only *C. imperialis clavatus*. Three specimens of *C. f. fissidens* were captured in April 1977, and February 1978 (2 females and 1 male). The females exhibit

19-21-17 and 21-21-17 scale rows, 127 and 130 ventrals, 75 caudals, 8-8 supralabials (the 4th and 5th entering orbit in both), 8-8 infralabials, loreal present, anal divided, total length 270 and 275 mm. The male has 22-21-17 scale rows, 116 ventrals, tail incomplete, 8-8 supralabials (4 and 5 entering orbit), 10-10 infralabials, loreal present, anal divided, length 320 mm. Those characteristics coincide with records for specimens from southern Veracruz, except in number of ventrals and caudals, which usually are 120 to 122 and 81 respectively, whereas 126 to 133 ventrals and 51 to 61 caudals occur in males of *f. proterops* from Central Veracruz (Xalapa).

The specimens here reported also possess the pattern characteristics of *f. fissidens*, as: no light temporal stripe through top of orbit, dorsolateral white stripe extending posteriorly a considerable distance on neck, and head and neck not black. Smith and Taylor (*op.cit.*) mention this subspecies from San Andrés Tuxtla, Veracruz.

Stenorrhina degenhardti mexicana (Steindachner)

This subspecies was cited in my previous list (*op.cit.*), but is included in the present account since it is a young specimen with remarkable differences from recorded adults, warranting description.

The present specimen is a female taken June 1976, and was identified by Dr. Hobart M. Smith; it has 17-17-17 scale rows, 139 ventrals, 42 caudals divided, anal divided, rostral separated from frontal and prefrontals, internasals fused with anterior section of nasal, 1 loreal, 1 preocular, 1 supraocular, 2 postoculars, prefrontals broadly separated from labials, 6-6 supralabials (3rd and 4th entering orbit), 7-7 infralabials, 1 anterior temporal; dorsal color red; 33 transverse dark bars on body and tail, reaching edges of ventrals; belly not pigmented, but with a dark spot in middle of each ventral, forming a longitudinal black line from 6th ventral to end of tail; belly red in life; tail short, less than one fifth length of body; top of head brown; gular scales more or less spotted; 165 mm total length (135 + 26).

Micrurus diastema sapperi (Werner)

One female was captured in February 1978, in the Station area; this specimen has 15-15-15 dorsal scale rows, 202 ventrals, 45 caudals divided, anal divided; 7-7 supralabials, 7-7 infralabials, 2 temporals; 14 black rings around body and 8 on tail, black rings on two scales; nuchal black band covering 3 to 4 scales; body with black and yellow rings between red aread, and only black and yellow rings (no red areas) on tail. Red areas wide, with very dark dorsal spots, as noted by Roze (1967) in *M. d. macdougalli*; total length 750 mm. I have found other specimens of *M. d. sapperi* also in the Coyame area at 340 m above sea level.

Micrurus limbatus Fraser

Two females were captured in June and December 1978. The specimens have 15-15-15 dorsal scale rows, 194 and 204 ventrals, 26 and 28 caudals divided, anal divided; 7-7 supralabials (3rd and 4th entering orbit), 7-7 infralabials, 1 anterior temporal, 2 preoculars, 2 postoculars, supralabial border light, except for the dark first three labials (only part of third dark in one specimen); scales in red areas lightly

dark marked; 40 black rings on body and tail (including nuchal), the black rings covering 2 to 3 dorsal scales on body, 4 to 5 scales on tail; a black dorsal spot on some read areas (one scale); no yellow rings on body and tail (uniformly red with only black rings); red areas short. Maximum total length of 650 mm. This species was registered from Volcán San Martín Tuxtla by Fraser (1964), and mentioned by Ramírez (1978) from Estación de Biología Tropical "Los Tuxtlas", in an unpublished work. My specimens were found at 160 m above sea level.

With these additions, the known snake fauna of the Estación de Biología Tropical "Los Tuxtlas" now includes thirty-seven species and subspecies; however, additional species certainly occur.

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CHECKLIST OF FRESHWATER TURTLES OF VERACRUZ, MÉXICO. II. CENTRAL PORTION OF THE STATE (TESTUDINES: CRYPTODIRA)

Gonzalo Pérez-Higareda

The present work comprises the second part of a statewide study of the freshwater turtles of Veracruz, which due to the complexity of adequately thorough surveys of the complete fluvial net throughout the state, was subdivided into three parts. The first part covered the southeastern portion of the state (Pérez-Higareda, 1978), between the basin of the Rio Papaloapan and Rio Tanalá. This, present, second part pertains to the central portion of the state, from Rio Nautla in the north to Rio Papaloapan. Both rivers pass entirely through the state, from Puebla and Oaxaca respectively on the west, to Barra de Nautla and Laguna de Alvarado, respectively, on the Gulf of Mexico (see map, Fig. 1). The third part of this work will pertain to the northern portion of Veracruz.

These three subdivisions were adopted strictly for their practical values in conduct of field work; they do not necessarily reflect natural biotic regions. Hence in the central region here treated some taxa have northern affinities, and some southern.

This survey was undertaken to clarify in greater detail than before the distribution of non-marine turtles of Veracruz, since previous knowledge was extremely sketchy, as summarized by Smith and Taylor (1950) and Casas Andreu (1967).

The studies thus far completed, in southern and central portions of Veracruz, have made abundantly evident the detrimental affect upon turtles of the state of the progressive perturbation of their habitats. Also, absence of such large species as *Dermatemys mawei* and *Chelydra serpentina rossignoni* in the central area has caused the focus of persecution to fall upon the "spotted turtle" and "jicotea" (*Pseudemys scripta venusta* and *P. s. cataspila*) due to their nutritional values. For these reasons these two subspecies, as well as *Dermatemys* and *Chelydra*, little by little are disappearing from the places where they used to be abundant.

Of the eleven taxa of freshwater or land turtles listed by Smith and Taylor (*op. cit.*) for Veracruz, nine occur to the central portion; *Kinosternon integrum* does not occur in the state at all, and *Terrapene carolina mexicana* is limited to the northern part of the state. However, two taxa have been added: *Kinosternon scorpioides cruentatum* and *Pseudemys scripta venusta*, both also ranging throug the southern portion. Hence eleven taxa are now confirmed as occurring in the central portion of the state.

There are reports of *Kinosternon herrerai* in the vicinity of Xalapa (Dr. Hobart Smith, personal communication), but I did not find it in that region, and doubt its occurrence there; my only collections are confined to localities in the basin of Rio Nautla in the northern part of the central region.

General Characteristics

The central portion of Veracruz consists of an extensive eastern area of low plains with warm climate, limited on the west by two important mountainous regions that project beyond the boundaries of the states of Puebla and Oaxaca, and which are part of the Sierra Madre Oriental. These two regions (Orizaba Alpine Region and Region of Xalapa), attain heights of up to 5,500 m (o.s.l.) and embrace a variety of climates from moderate to extreme cold with an annual median temperature between -2 and 0° C (cf. García, 1970).

In the coastal plains, the basins of the rivers Nautla, Actopan, Jalcomulco, Atoyac, Blanco and Papaloapan enclose elevations no greater than 500 m o.s.l., as in the regions of Martínez de la Torre, Misantla, Zempoala, Soledad de Doblado, etc., where for the most part secondary vegetation and grassland are predominant with some vestiges of rainforest. Toward the south the humidity and warnth increase, culminating in the great low regions of Papaloapan, composed over most of its extent of palm tree and swamp zones, with remnants of rain forest also (cf. Gomez-Pompa, 1978).

The confluent regions of Orizaba and Xalapa are continuous northeasterly as a mountain extension that nearly reaches the coast, dividing the state of Veracruz near the middle, at approximately paralled 20°, in the Palma Sola region. Here the foothills create a barrier thru the littoral zone several kilometers long. The resultant corridor, not more than one kilometer wide between the mountains and the coast, is cut by the Palma Sola river, creating the Platanal and Palma Sola basins invaded by brackish currents. Therefore, the coastal plain of the state is divided into two parts of great orographic importance, with remarkable biotic influence (see map, Fig. 2).

Localities Sampled

Attempts were made to collect turtles at all of the following localities, listed with the nearest town or the containing municipality (arranged in alphabetical order) and elevation. An asterisk indicates sites where no turtles were found.

Town or Municipality	Locality	Elevation (in m) Above Sea Level
Alvarado	La Encantada	9
Alvarado	Camaronera	9
Apazoapan	Rio Jalcomulco	-
Boca del Rio	5 km W of	3
Boca del Rio	Rio Jamapa	3
Candelera	Rio M. de la Torre	-
Cardel, Villa	streams	6
Carlos A. Carrillo	Rio Papaloapan	8
Colipa	Rio Colipa	-
Cosamaloapan	Rio Papaloapan	6

Town or Municipality	Locality	Elevation (in m) Above Sea Level
Emilio Carranza	Rio Juchique	-
Encantada, La	Rio Papaloapan	9
Espuma	Rio Actopan	-
Fortín de las Flores	* Rio Blanco	1030
Huiloapan	* Rio Blanco	1240
Huanal	Rio Misantla	-
Ixhuatlán	Rio Atoyac	-
Juchique de Ferrer	Rio Juchique	800
Mata Espino	Rio Atoyac	-
Medellín	ponds	18
Medellín	Rio Jamapa	18
Naranjos, Los	Rio Hondo	-
Nogales	* Rio Blanco	1240
Nopaltepec	Rio de Nopaltepec	322
Palma Sola	Rio Palma Sola (R. Limón)	6
Paso de la Anona	Bajos Rio Atoyac	-
Paso de Ovejas	Rio Panoaya	160
Paso del Toro	streams	22
Plan de Las Hayas	Rio Juchique	10
San Antonio	Rio Papaloapan	6
Soledad de Doblado	Rio Jamapa	77
Tejar, El	swamps	18
Telaya	Rio Nautla	-
Tezonapa	2 km S of	500
Teocelo	* Rio Teocelo	1218
Tlacotalpan	Lag. El Corralillo	6
Tlapacoyan	Rio M. de la Torre	5
Veracruz	La Matamba (Mata Tambora)	-
Veracruz	streams Playa Norte	16
Veracurz	swamp "Lagartos"	16
Veracruz	Road to Matamba	70
Veracruz	Laguna Norte	15

Town or Municipality	Locality	Elevation (in m) Above Sea Level
Yanga	swamps	700 ?
Zempoala	Rio de Zempoala	25

List of Species

In the following list, the first paragraph for each account cites the localities at which the species was found in the present survey. The second paragraph summarizes published information on distribution, both within and extraneous to central Veracruz.

Dermatemys mawei Gray

Localities of capture. Alvarado: La Encantada. This species is at present virtually absent in the central portion of the state

Additional data. Veracruz, Oaxaca, Tabasco, Yucatán and Campeche (Smith and Taylor, 1950). Tabasco: Basin of Rio Usumacinta; Veracruz: Minatitlan, Arroya Hondo; Basin of Rio Papaloapan (Casas Andreu, 1967). Northern and northeastern Chiapas (Alvarez del Toro, 1972).

Chelydra serpentina rossignoni (Bocourt)

Localities of capture. Boca del Rio: 5 km W; Tezonapa: 2 km S.

Additional data. Atlantic slopes south to the Yucatan Peninsula; recorded only from the states of Veracruz and Campeche (Smith and Taylor, 1950). Veracruz: Basin of Rio Papaloapan, probably near Alvarado, and Catemaco-Acayucan road (Casas Andreu, 1967). Chiapas (Alvarez del Toro, 1972). Veracruz: Isla, San Andrés Tuxtla, Catemaco; Oaxaca: Valle Nacional (Pérez-Higareda, 1978).

Kinosternon acutum Gray

Localities of capture. Nopaltepec: Rio Nopaltepec; Carlos A. Carrillo: Rio Papaloapan.

Additional data. Central Veracruz and Tabasco (Smith and Taylor, 1950).

Kinosternon scorpioides cruentatum (Duméril and Bibron)

Localities of capture. Boca del Rio: Rio Jamapa; Paso de Ovejas: Rio Panoaya; Soledad de Doblado: Rio Jamapa; Ixhuatlán: Rio Atoyac; Espuma: Rio Actopan.

Additional data. Atlantic and Pacific drainages in Oaxaca, Tabasco, Campeche and Chiapas; Cozumel Isl.; Progreso and Telchac Puerto, Yucatán (Smith and Taylor, 1950). Between Tehuantepec and San Mateo del Mar, and Tamaulipas (Casas Andreu, 1967). Chiapas: Tonalá and Tapachula (Alvarez del Toro, 1972).

Kinosternon leucostomum leucostomum (Duméril and Bibron)

Localities of capture. Boca del Rio: Rio Jamapa; Veracruz: Matamba and streams of the Playa Norte; Tlacotalpan: Laguna El Corralillo; Yanga: swamps; Tezonapa: 2 km S of; Paso de Ovejas: Rio Panoaya.

Additional data. Puebla, Veracruz, Tabasco, Campeche and Chiapas (Smith and Taylor, 1050). Tabasco: Teapa, and Tepijulapa, El Chico Zapote, Villahermosa; Veracruz: Alvarado, Minatitlán and Coatzacoalcos (Casas Andreu, 1967). Northern Chiapas (Alvarez del Toro, 1972).

Kinosternon herrerai Stejneger

Localities of capture. Tlapacoyan: Rio Martínez de la Torre; Candelero: Rio M. de la Torre; Telaya: Rio Nautla.

Additional data. La Laja (Smith and Taylor, 1950).

Claudius angustatus Cope

Localities of capture. Boca del Rio: Rio Jamapa; El Tejar: swamps; Veracruz: Bajos Playa Norte and Matamba; Paso del Toro; Cardel; Zempoala; Mata Espino: Rio Atoyac; Medellín; Paso de la Anona: Bajos Rio Atoyac.

Additional data. Southern Veracruz to Honduras; Tabasco and Campeche (Smith and Taylor, 1950). Alvarado and Tlacotalpan, Ver.,; El Chico Zapote, Tab. (Casas Andreu, 1967). Juárez, Chiapas (Alvarez del Toro, 1972).

Staurotypus triporcatus (Wiegmann)

Localities of capture. Medellín; Boca del Rio; Veracruz: swamps of Matamba; Paso del Toro; El Tejar; Soledad de Doblado; Mata Espino.

Additional data. Veracruz coasts and Tabasco (Smith and Taylor, 1950). Alvarado, Minatitlán, Laguna de Catemaco, Ver.,; Villahermosa, Tab.; Laguna de Agua Fría, near Emiliano Zapata, Chis. (Casas Andreu, 1967). Northern Chiapas (Alvarez del Toro, 1972).

Pseudemys scripta venusta (Gray)

Localities of capture. Medellín; Veracruz; Boca del Rio; Alavarado; San Antonio; Cosamaloapan; Los Naranjos: Rio Hondo; Palma Sola: Rio Palma Sola (Rio Limón); Zempoala: Rio Zempoala and Mozomboa.

Additional data. Veracruz (Smith and Taylor, 1950, lumped with *P. s. cataspila*).

Pseudemys scripta cataspila (Günther)

Localities of capture. Emilio Carranza and Juchique de Ferrer: Rio Juchique; Colipa; Huanal: Rio Misantla; Candelero: Rio M. de la Torre.

Additional data. Recorded from the states of Tamaulipas and Veracruz (Smith and Taylor, 1950).

Rhinoclemys areolata (Duméril and Bibron)

Localities of capture. Not found in the central portion.

Additional data. Recorded from central Veracruz, Tabasco, Campeche, Yucatán and Quintana Roo (Smith and Taylor, 1950). Veracruz and Alvarado (Dr. H. M. Smith, personal communication).

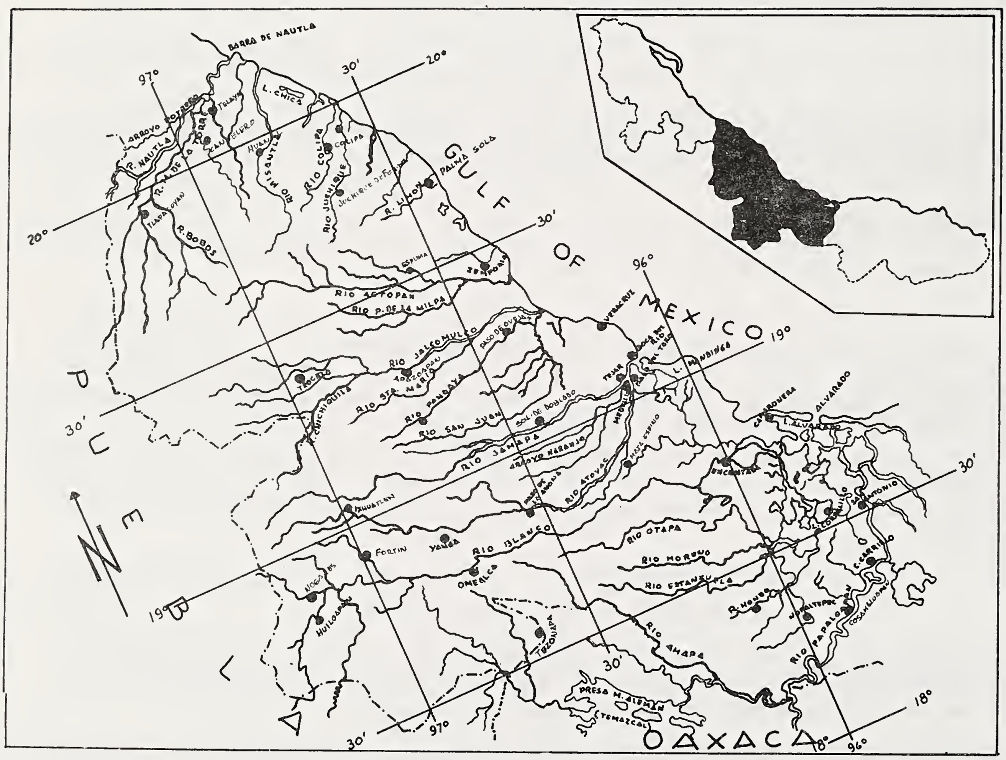

Fig. 1. Map of central Veracruz, showing localities of collection of turtles

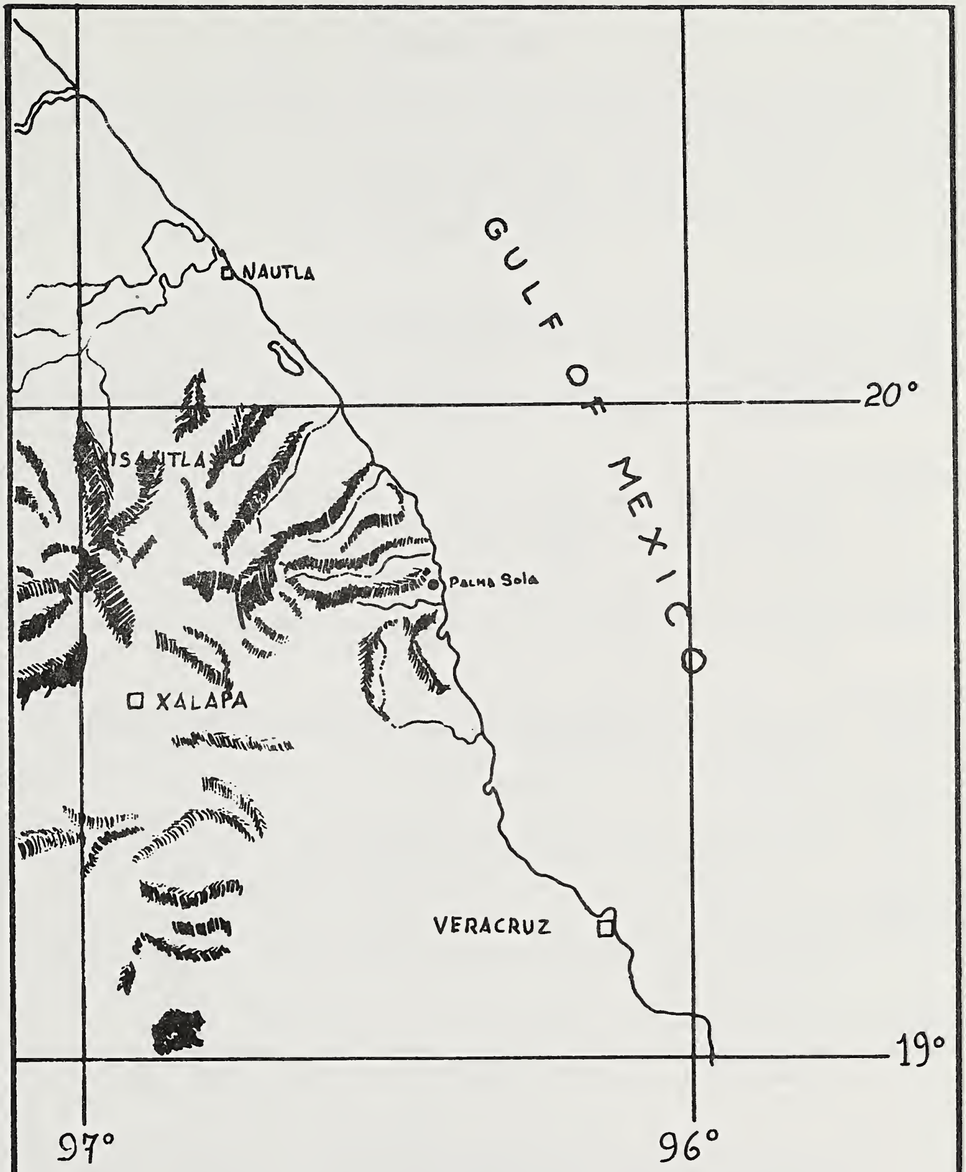

Fig 2. Map illustrating the barrier formed by the minor elevations of the Sierra Madre Oriental, dividing in half the state of Veracruz near parallel 20° (adapted from Operational Navigation Chart ONC J-25).

Acknowledgments

I thank Dr. Hobart M. Smith of the University of Colorado for his aid throughout all my herpetological work, his help in the identification of the *Kinosternon* species, and for the manuscript revision. Thanks are due also to my colleague resident of the Estación de Biología Tropical, Biol. Daniel Navarro L., for his collaboration in the field and laboratory; to Biol. Enrique González S., head of the Station, for the facilities given to develop the present work; and to Lucía Muñoz for her participation in translation.

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News & Notes

A Saharan Surprise and a Desert Mystery

In the spring of 1979 (April-May) for the second time the writer was afforded the chance to travel in the Algerian Sahara Desert back of the Atlas Mountains far beyond Metropolitan Algiers. Once over the crest of the mountains strung along the Mediterranean littoral the North African landscape becomes more and more arid with each mile, the vegetation increasingly sparse until about fifty to seventy-five miles inland the true desert begins.

Contrary to popular belief the Sahara, or at least the Algerian portion of it, is not made up of endless sand dunes - although there are large areas where dunes occur - but rather of vast stretches of bare rock supporting little or no soil; much of the rock is sharp and jagged; there are bleak sun-drenched low mountains, brown and eroded, deep ravines and worn gullies testifying to rare floods or the former courses of vanished creeks and rivers. There is evidence that in the distant past much of the present desert was well-watered; on the northern reaches there are even a few ruined Roman cities complete with aqueducts, now completely dry.

The Algerian Sahara, like other regions of the great desert has a number of widely scattered oases, some large, some quite small, often a hundred or more miles apart. They are typically North African, some possessing only a few date palms and other desert vegetation; others are some miles in extent with many thousands of date trees growing in clusters or strung out along hidden underground moisture pockets.

One of these oases, Bou Saada, located over 150 miles beyond the Atlas range is in true desert country and is surrounded by low, bleak rock mountains, and to the east and south by miles of rose-colored sand dunes, very beautiful and very desolate. Bou Saada owes its existence to a small stream of water which gushes out of the rocks about three or four miles to the south, flows through a deep rocky gorge, then enters the oasis itself, which encloses a small desert town, and which then disappears into the thirsty sand dunes just beyond the village. Except on rare occasions of rain the stream is little more than twenty feet in width and possibly five miles in total length. It has, however, been flowing to some degree for several centuries because on its banks, above the oasis of Bou Saada itself, is an ancient mosque with an attached Arab village dating back to about the 14th century. Neither the village nor the mosque could have existed without the life-giving waters of the ancient stream.

Along its course it drops precipitously from a small plateau over a waterfall of about fifty feet in height. It is a picturesque scene, but less than a hundred feet from the falls the desert takes over and all vegetation except for a few thorn bushes disappears. It was startling then, against the background of falling water and the enclosing desert silence, to hear the unmistakeable calling of mating frogs! At first the voices were thought to be the notes of desert birds, but they were not; the pools above the waterfall were alive with small frogs. They were about two-thirds the size of our common pickerel frogs and with much the same reticulated pattern.

The species, however, was unknown to the writer and, today, I have no clue to their precise identity or even if they have ever been collected and properly classified. One does not ordinarily expect frogs in the middle of the Sahara Desert, even in an oasis. Being completely unprepared for this unexpected event no preserving equipment or materials were available and, so, no specimens could be collected.

These frogs pose some intriguing questions. First, how did they get there? The Bou Saada stream centuries ago conceivably could have been one of a system of active rivers when the Sahara was relatively well-watered, and conceivably these frogs may have been widespread when the river systems were flowing. Then, as the rivers slowly dried through the centuries and the water table fell, the frogs retreated, perpetuating themselves in whatever residual water was left until only the exceedingly short Bou Saada stream remained. The present frog population is restricted to less than one half mile of water. If ever there was an organic population existing on the ragged edge of survival it is these frogs of Bou Saada. Are these amphibians an unknown species? Are they endemic to Bou Saada alone? Or were they, at some moment in the oasis' history, artificially introduced, perhaps to grace the garden of some well-to-do Arab villiger who had a liking for frog voices in the spring? Possible, but unlikely in view of the miles of desert to be traversed from the coast until a few years ago only by camel, horseback or on foot.

The question of the Bou Saada frogs was compounded several days later when the much larger oasis of Biskra was visited. To get to Biskra from Bou Saada one must traverse another 125 miles or so of completely arid desert, a region again of intermittent rocks and sand dunes almost like a moonscape in bleakness. Except for a rare nomad tent in the distance and a few sand-colored desert birds, there is no life; nothing moves, nothing breaks the infinite distance of dry, parched land. Yet, Biskra and its companion oasis of Tolga supports thousands of date palms and a very considerable Arab town of quite ancient lineage. The old portion of Biskra is a veritable maze of stone walls protecting groves of date palms and gardens. For a desert oasis there is a reasonable supply of water welling up from underground and carefully led by an intricate series of ancient irrigation ditches to the gardens enclosed by the walls. While there is not much water, there is enough to create a limited number of small semi-stagnant pools and tiny rivulets. On one side Biskra is bordered by a dry river bed of some size. At times it must temporarily run with water but none was remotely visible during my sojourn. But back in old Biskra, in the stagnant pools, the frogs were there, very similar to those at Bou Saada and, in addition, another smaller species. Again no collecting was possible.

The Biskra frogs are not in quite the same danger of extinction as the Bou Saada population but their chances are still exceedingly thin. The oasis is rapidly changing due to an ever-expanding human population and the days of the Biskra frogs may be severely numbered.

Beyond Biskra, even deeper in the Algerian desert are the even more remote oases of Laghout, Ourgla, Ghardia, Timoum and Tamarasset, to mention only a few of the more important; some of these are hundreds of miles from water and have been in desert isolation for long centuries. Do they have frog populations, too? It would be interesting to know.

--Gilbert C. Klingel, *Grimstead, Virginia*

Received 23 January 1980

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--Thomas Vermersch, *Herpetological Slide Bank, c/o Living Jungle, 5118 Anna Maria, San Antonio, Texas 78214. (512)923-1761*

Corregenda

Vance, Thomas. 1978. A Field Key to the Whiptail Lizards (*Genus Cnemidophorus*). Part I: The Whiptails of the United States. Bull. Md. Herp. Soc. 14(1):1-9.

Page 3: 1. Delete last half of each statement of couplet 13.

2. Substitute *C. tigris reticuloriens* for *C. tigris marmoratus* of couplet 22.

3. Substitute *C. tigris marmoratus* for *C. tigris reticuloriens* of couplet 24.

Page 5: Fig. 2 #4 should read *C. t. stejnegeri*

NOTES

Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

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DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

MDHS........A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

JUNE 1980

VOLUME 16, NUMBER 2

Bulletin of the Maryland Herpetological Society

Volume 16 Number 2 June 1980

CONTENTS

NEWS & NOTES

The Maryland Herpetological Society
Department of Herpetology
Natural History Society of Maryland, Inc.
2643 North Charles Street
Baltimore, Maryland 21218

BULLETIN OF THE mdhs

Volume 16 Number 2 June 1980

The Maryland Herpetological Society

Department of Herpetology, Natural History Society of Maryland, Inc.

Library of Congress Catalog Card Number: 76-93458

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 16 | 30 JUNE 1980 | NUMBER 2

CHECKLIST OF FRESHWATER TURTLES OF VERACRUZ, MEXICO
III. NORTHERN PORTION OF THE STATE (TESTUDINES: CRYPTODIRA)

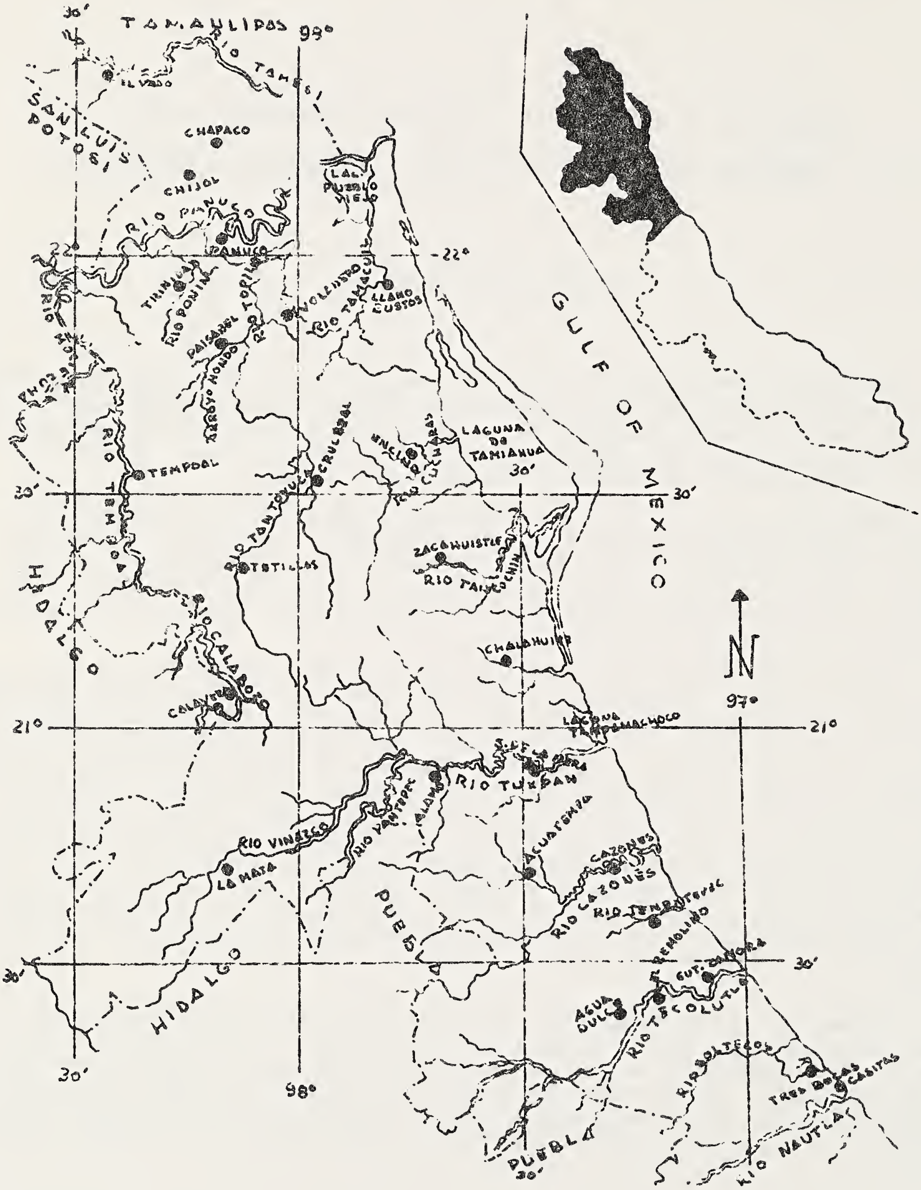
Gonzalo Pérez-Higareda

The present work is the third and last part of a statewide survey of the freshwater turtles of Veracruz, México, which for logistic reasons was developed in three more or less equal parts, representing southern, central and northern Veracruz. Intensive field work was carried out in each of these three regions. The only previous list for Veracruz is that of Smith and Taylor (1950).

The southern portion of the state (Pérez-Higareda, 1978) extends between the basins of Rio Tonalá at the south, the Rio Papaloapan in the north. The central portion (Pérez-Higareda, 1980) extends northward from Rio Papalopan through Rio Nautla. This third part of the study covering the northern portion of the state concerns the area between the basins of Rio Nautla and Rio Tamesí, at the northern boundary of the state (Fig. 1).

Of the 11 taxa cited for Veracruz by Smith and Taylor (*op. cit.*), 4 occur in the northern portion (*Kinosternon integrum* does not occur in the state at all), and two more have been added in the present study. *Kinosternon f. flavescens* was not found by myself, in spite of the fact that it was persistently sought; however, two registries of this species are known from the northern extreme of Veracruz: 35 mi S and 51 mi S Tampico, Tamaulipas (Dr. Hobart M. Smith, pers. comm.). *Gopherus berlandieri* has not been found in Veracruz before the present study; the previously know registries for this species are limited to the northern desert regions from Brownsville, Texas, to Nuevo León and Tamaulipas (Smith and Taylor, *op. cit.*). One specimen was captured by myself in the region of Chijol, and I am aware of another specimen taken near Chapaco Nuevo, Veracruz. These specimens are the basis for a new state record, and at the same time a new southernmost range limit. Six species or subspecies are now known from northern Veracruz, and 14 taxa for the state as a whole.

Although the three surveys now reported in this series constitute by far the most intensive undertaken for turtles in the state (and indeed in all of Mexico), they cannot be considered as the last word on the subject. A careful exploration of the high plains of the state, for example west of Orizaba, Xalapa and Perote, is almost sure to reveal the existence of species, particularly of *Kinosternon*, characteristic of that region, distinctive for its high elevation but moderate climate.


TAMAULIPAS
99°
RIO TAMESI
SAN LUIS POTOSI
CHAPACO
CHIJOL
RIO PANUCO
PANUCO
LAG. PUEBLO VIEJO
22°
LLANO CUSTOS
PAISANO
ARROYO HONDO
TEMPOAL
LAGUNA DE TAMIAHUA
GULF OF MEXICO
30'
TETILLAS
ZACAHUISTLE
HIDALGO
CHALAHUITE
N
97°
21°
RIO CALABOZO
LAGUNA TAMPAMACHOCO
RIO TUXPAN
RIO VINAZCO
LA MATA
PUEBLA
RIO CAZONES
CAZONES
REMOLINO
AGUA DULCE
RIO TECOLUTLA
TRES BOCAS
CASITAS
RIO NAUTLA
98°

In my survey of Veracruz, turtles were sought in 50 localities in the southern zone, 44 in the central part, and 28 in the northern region, making a total of 122 localities scattered over the whole State. I trust that the data derived from this survey may serve as a stimulus for future work on the freshwater and land turtles of Veracruz.

General Characteristics

The northern portion of the state is characterized by low plains of more or less uniform contour, and with an elevation in general no more than 300 or 400 m above sea level, except for the small Sierra de Tantima near parallel 21°, with a maximum elevation of 700 m (a.s.l.).

The coastal plain has a warm humid climate, and only in the regions near the borders of Hidalgo and Puebla, to the west, do moderate climates occur (cf. Garcia, 1970).

The dominant vegetation, as in most other parts of the state, is secondary growth among palm trees and grassland. In the extreme north a desert zone occurs between the basins of the rivers Pánuco and Tamesí; for more information see Gómez-Pompa (1978).

This portion of the state is irrigated by a fluvial seine coming from the rivers Tamesí, Pánuco, Tuxpan, Cazones, Tempoal, Tecolutla, and Nautla principally (see map, Fig. 1).

Localities Sampled

Attempts were made to collect turtles at all of the following locatities, listed with the nearest town or the containing municipality (arranged in alphabetical order). An asterisk indicates sites where no turtles were found.

Town or Municipality	Locality
Acuatempa	Rio Cazones
Agua Dulce	Rio Tecolutla
Alamo	Rio Tuxpan
Calavera	*Rio Calabozo
Casitas	near Tres Bocas
Casitas	near town
Cazones	Rio Cazones
Calahuite	Rio de la Barra
Chapaco Nuevo	near town
Chijol	near town
Crucetal	Rio Tantoyuca

Town or Municipality	Locality
Gutiérrez Zamora	Rio Tecolutla
Gutiérrez Zamora	swamps
Llano de Bustos	Rio Tamacuil
Mata, La	*Rio Vinazco
Ozuluama	Rio de Encino
Pánuco	3.5 km S
Paisabel	Arroyo Hondo
Poiutla, N de	Rio Tenextepec
Santiago de la Pera	near Rio Tuxpan
Remolino, El	Rio Tecolutla
Tempoal	*Rio Tempoal
Tetillas	*Rio Tantoyuca
Tres Bocas	Arroyo Tres Bocas
Trinidad	Rio Ponin
Vado, El	*Afl. Rio Tamesí
Volador	stream "El Ferrocarril"
Zacamixtle	Rio Tancochín

List of Species

In the following list, the first paragraph of each account cites the localities at which the species was found in the present survey. The second paragraph summarizes published information on distribution.

Kinosternon scorpioides cruentatum (Duméril and Bibron)

Localities of capture. Trinidad: Rio Ponin; El Volador: stream "El Ferrocarril".

Additional data. Atlantic and Pacific drainages in Oaxaca, Tabasco, Campeche and Chiapas; Cozumel Isl.; Progreso and Telchac Puerto, Yucatán (Smith and Taylor, 1950). Between Tehuantepec and San Mateo del Mar, and Tamaulipas (Casas Andreu, 1967). Chiapas: Tonalá and Tapachula (Alvarez del Toro, 1972).

Kinosternon herrerai Stejneger

Localities of capture. Acuatempa; Rio Tecolutla; Rio Cazones, Rio Tenextepec; Rio Tantoyuca; Rio Tancochín; Rio Tuxpan; localities of Volador, Gutiérrez Zamora, Cazones, Poiutla, Crucetal, Paisabel: Arroyo Hondo, Zacamixtle, Agua Dulce, Alamo.

Additional data. La Laja (Smith and Taylor, 1950).

Kinosternon flavescens flavescens (Agassiz)

Localities of capture. Was not found by myself.

Additional data. 35 mi S and 51 mi S Tampico, Tamps. (Dr. Hobart M. Smith, personal communication). Northern Mexico from Coahuila to Tamaulipas (Smith and Taylor, 1950).

Gopherus berlandieri (Agassiz)

Localities of capture. Chijol and Chapaco Nuevo. This is a new record for Veracruz.

Additional data. Nuevo León, Tamaulipas and Coahuila (Smith and Taylor, 1950).

Pseudemys scripta cataspila (Günther)

Localities of capture. Gutiérrez Zamora, El Remolino, Zacamixtle, Ozuluama, Cazones, Llano de Bustos, Tres Bocas, Chalahuite and Alamo; rivers Tecolutla, Tancochín, De Encino, Cazones, Tamacuil, De la Barra, Tuxpan, and Arroyo de Tres Bocas.

Additional data. Recorded from the states of Tamaulipas and Veracruz (Smith and Taylor, 1950).

Terrapene carolina mexicana (Gray)

Localities of capture. Casitas, Santiago de la Pera, Pánuco, Ozuluama: Encino.

Additional data. Atlantic slopes from central Tamaulipas and eastern Nuevo León to northern Veracruz (Smith and Taylor, 1950, under the name *T. m. mexicana*).

Acknowledgments

I want to thank Dr. Hobart M. Smith of the University of Colorado for his editorial help with all three parts of the present series. Thanks go also to my field colleague Biol. Daniel Navarro L. and to Lucía Muñoz for her participation in translation.

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A RANGE EXTENSION FOR THECADACTYLUS RAPICAUDUS (GEKKONIDAE) IN MEXICO, AND NOTES ON TWO SNAKES FROM CHIAPAS

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Thecadactylus rapicaudus is added to the herpetofaunal list of Chiapas.

This gecko was known from some localities in Southeastern México: Chichén Itzá, Puz Cave, Oxkutzkab, Chakxix Cave and Tekax in Yucatán according to Smith and Taylor (1950) and from Quintana Roo (Smith and Smith, 1976). Another published record is from Guadalajara, Jalisco, by Cope in 1887 (cited by Smith and Taylor, op. cit.) but we feel that the occurrence of this species in Jalisco must be ruled out on a geographic-ecological basis.

One specimen in the collection of the Instituto de Historia Natural del Estado de Chiapas, an adult female (cat. number 1147) collected 25 July 1978, extends the known range of this lizard nearly 350 km to the SW of the nearest recorded locality (Tekax).

The specimen was taken in the tropical rainforest surrounding Palenque, from a tree trunk coated with moss and lichen.

Fitch (1970) has already reported arboreal habits for this species, but almost nothing is know about its ecology.

This female measures 101 mm in standard length plus 45 mm tail length. It shows two light dorsolateral stripes from the posterior margin of eye to above the insertion of the foreleg; this stripe continues interruptedly to the inguinal area. The dorsal pattern comprises 11 dark crossbands terminating at the nape.

Upon dissection, we found an egg 9 mm in diameter; this fact supports the idea of an egg-laying period in the midst of the rainy season, implicit in a record by Beebe (1944) of a female from British Guiana laying an egg 25 August 1922.

Concerning snakes, three *Thamnophis proximus rutiloris* were caught on 15 December 1972 in the sand dunes on the beach of Puerto Arista.

This subspecies has been collected near Ocozocoautla (Alvarez del Toro, 1973) but the habitat there is mainly tropical deciduous forest with a nearby swampy area, while at Puerto Arista, the coastal sand dunes are covered by scattered halophilous plants, and there are no permanent freshwater bodies.

All this points towards an extremely wide environmental tolerance of *T. proximus rutiloris*.

Given the distribution of *rutiloris* and that of the remaining subspecies of *proximus*, mainly in the Atlantic versant; the most suitable passageway for *rutiloris* to arrive to the Pacific coastal plains, seems to be the low area at the NW end of the Sierra de Chiapas range on the Isthmus of Tehuantepec.

Not enough data exist to define the ways in which these snakes have adapted to such different habitats.

Our specimens are assigned to *rutiloris* (table 1).

Table 1. Comparison between *T. P. rutiloris* from Arista and Ocozocoautla.

Nos.	Sex	Locality	Dorsals	Ventrals	Caudals	Lateral Stripe/Rows
11161HN	♀	Arista	19-17	152	92	3-4
11181HN	♂	"	19-17	153	107	3-4
11171HN	♀	"	19-17	147	90	3-4
07151HN	♂	Ocozocoautla	19-17	158	109	3-4
07141HN	♂	"	19-17	161	mutilated	3-4

Finally, a female coral snake (*Micrurus diastema sapperi*) from Rancho Alejandría, Mpio. Juárez (cat. number 10121HN) was collected 12 May 1970, under leaf litter in a cacao plantation 60 m above sea level.

This specimen has a total length of 890 mm and it appears to be a record size for this subspecies (and seemingly for the species).

Its general squamation follows: 15 dorsal rows, 222 ventrals, 41 subcaudals

The nuchal ring is continuous on the chin and the black pigment of the snout involves the supralabial borders.

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NOTES ON NESTING OF Crocodylus moreleti IN SOUTHERN VERACRUZ, MEXICO

Gonzalo Pérez-Higareda

The present notes report some nesting characteristics of the swamp crocodile, *Crocodylus moreleti* (Duméril and Bocourt), observed in the vicinity of Arroyo Agrio (Lago de Catemaco), Municipality of Catemaco, southern Veracruz, Mexico. Very few data have been recorded on the reproduction of *C. moreleti*, and discrepancies exist among the references that do exist.

My observations are based on the finding of a next, in August 1979, constructed over an accumulation of aquatic lilies in a marshy area, near the lake edge but in water, not on firm land. This system of aquatic nesting coincides with Campbell's (1972) report for this area, but differs from the behavior pointed out by Alvarez del Toro (1972) for the same species in Chiapas.

The area occupied by the nest had a diameter of about 3 m and contained more than 70 eggs dispersed and exposed. A large, robust female of nearly 3 m total length, about 2.5 m away from the water's edge, was guarding the nest. Angered by the proximity of the boat, the female shook her tail nervously. At present specimens of this size rarely can be found at Catemaco, although medium-sized speciments are often seen.

Five white eggs with a resistant shell, and similar in shape to hen's eggs, were taken from the next. They measured 10 cms. in length, and were transported for incubation on humid sand at ambient temperature (26-27°C). All hatched 6 September, the hatchlings measuring between 16 and 17 cm in total length. They were of yellow coloration with dark bars and spots, and are retained alive for observations on growth.

I have not observed the nesting behavior of *C. moreleti* in other localities. Perhaps the difference between the Chiapas nesting behavior and that of the Catemaco region may be explained by habitat peculiarities of the latter area as compared with the swamps where the species usually is found.

Acknowledgments

I thank Dr. Hobart M. Smith of the University of Colorado for the manuscript revision, and also Mr. Walfer Oranista, fisherman from Catemaco, Ver., for discovery of the next and for his help in the collection of the eggs.

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THE FAUNISTIC DISTRICTS OF THE LOW PLAINS OF VERACRUZ, MEXICO, BASED ON REPTILIAN AND MAMMALIAN DATA

Gonzalo Pérez-Higareda and Daniel Navarro L.

In consideration of the importance in zoogeographic studies of the elevations which, as part of the Sierra Madre Oriental mountains, bisect the coastal plain of Veracruz, from the state of Puebla to the littoral of the Gulf of Mexico (on parallel 20°, approximately), and which consequently create a coastal "strait", we have attempted to evaluate and quantify the widely neglected nature and significance of the responsible physiography, based on the distribution of reptiles and terrestrial mammals. In this context, species of wide distribution throughout the coastal plain of Veracruz were found to be especially important as for example, in reptiles, the "tortuga verde" (green turtle) *Pseudemys scripta cataspila* of the northern region, and the "tortuga pinta (spotted turtle) or "jicotea" (*Pseudemys scripta venusta*) of the southern region of the state. In mammals, the rodent known as "serete" or "agutí" (*Dasyprocta mexicana*), conforms in distribution, occurring through the plains and lowlands of Tabasco to Paraje Nuevo, Veracruz (Hall and Kelson, 1959).

The limit of the above mentioned geographical barrier is precisely parallel 19°50' latitude North, between the town Plan de las Hayas (or Punta Morro) and the harbour-bars Plantanal and Palma Sola, in Palma Sola, Veracruz. Our observations coincide in many respects with the data provided independently by various other authors, and it is our intention, in this work, to document on the basis of the distribution of terrestrial vertebrates, the existence of two faunal Districts in the coastal plain and the lowlands of the Veracruzan Biotic Province.

Veracruz as a Biotic Province

Moore (1945:218), Goldman (1951:115) and Goldman and Moore (1946:357) regard the Veracruzan Biotic Province as embracing from the lowlands of San Luis Potosí, southern Tamaulipas and northeastern Puebla, southward through Veracruz and Tabasco, including small portions of northern Oaxaca and Chiapas. These are the limits we have accepted for this work, including the whole of the coastal plain of the state of Veracruz. Lowery and Dalquest (1951) and Hall and Dalquest (1963) follow, approximately, the same interpretation as Goldman and Moore (1946), but partition Veracruz into what they name Upper Tropical Life-Zone and Lower Tropical Life-Zone. The boundary of the first is located at 1,830 meters of altitude and of the second at 560 meters; they correspond to a part of Moore's Transverse Volcanic Biotic Province.

Smith (1941), using the distribution areas of the genus *Sceloporus* for the delimitation of the Biotic Provinces of Mexico, places northern Veracruz in the Veracruzan Biotic Province and southern Veracruz in the Petén Province, considering the parallel 20° as the approximate boundary between the two Provinces. This boundary is the same as the one we have discerned, formed where the Sierra Madre Oriental mountains divide the coastal plainof Veracruz into northern and southern sections.

On a much broader scale, Cabrera and Willink (1973) included most of Veracruz in what they called "Pacific Province", south of parallel 20°, north of which is their "Mexican Xerophile Province"; the high regions of the Sierra Madre Oriental they placed in a "Mesoamerican Mountain Province." This division is rather general and was therefore not utilized in the present account; it is nevertheless of interest in the importance assigned to parallel 20°.

General Data on the State of Veracruz

The state of Veracruz is limited northward by the state of Tamaulipas. To the west it includes the Sierra Madre Oriental in the states of San Luis Potosí, Puebla and Oaxaca, and to the southeast it borders the state of Tabasco. Fundamentally it consists of a coastal plain interrupted, in certain extent, by the Sierra de Tantima in the northern part, where there are elevations of nearly 700 meters; the eastern tip of the Sierra Madre Oriental, with elevations up to 5,747 meters, in the central part; and the Sierra de Los Tuxtlas, with elevations of 1,700 meters, in the southern part of the state. Mostly, it presents altitudes lower than 300 meters and the most notorious alteration of this pattern is at the point near parallel 20° where the Sierra Madre Oriental extends virtually to the Gulf coast (Figure 1).

Climate

There is a great variety of climates in the state, going from those of cold type (ETH, according to the Köppen System, modified by García, 1970), to the calid humid climates Am and Af(m). In order to represent the climatic conditions in relation to altitude and latitude, we have indicated in Figure 2 the climatic characteristics at 3 meteorological stations: one north of parallel 20° (Tuxpan); another at the point of said parallel (Perote) at high altitude; and one south of the same parallel (Coatzacoalcos).

A climatic character of extraordinary importance for the distribution of animal organisms is the number of frost days a year. Soto (1969) presents an interesting map which we reproduce in Figure 3, in which she separates the state in 3 sections, of which two have 0 frost days a year, and one from 0 to 10 a year, reaching a maximum of 40 days, in the high regions of the mountains.

Hydrology

There are many rivers in Veracruz, all flowing into the Gulf of Mexico. The most important ones, because of their volume, are: Pánuco, Tuxpan, Tecolutla, Nautla, Jamapa, Papaloapan and Coatzacoalcos. A small fluviatic net is formed mainly by the Palma Sola river, which contains a considerable proportion of brackisk water and causes, at its mouth, the formation of the harbour-bars Palma Sola and Platanar. This river comes down from the mountainous region of the Sierra Madre Oriental and closes the orographic belt which divides the low regions in the state.

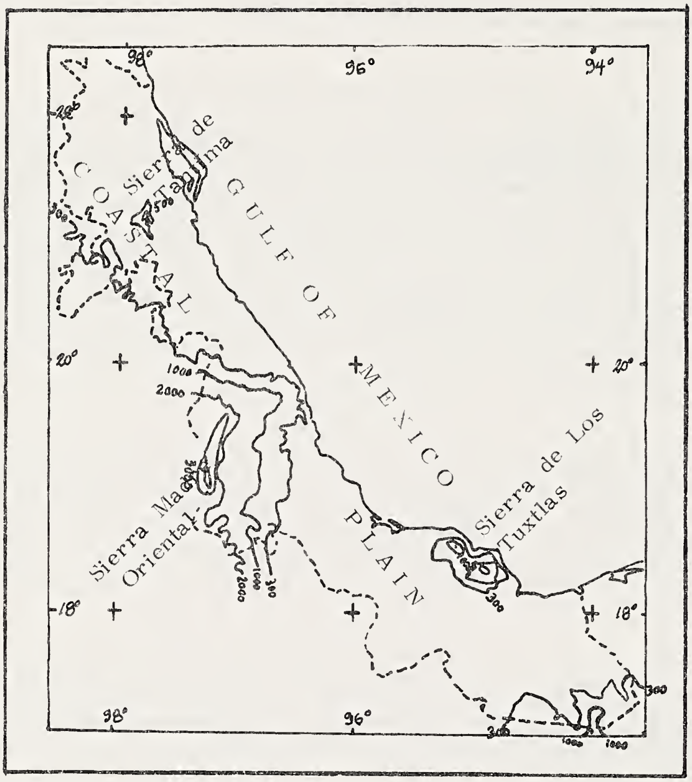

Fig. 1. Altimetric map of Veracruz. From USAF Navigation Chart, after Gómez-P., 1978.

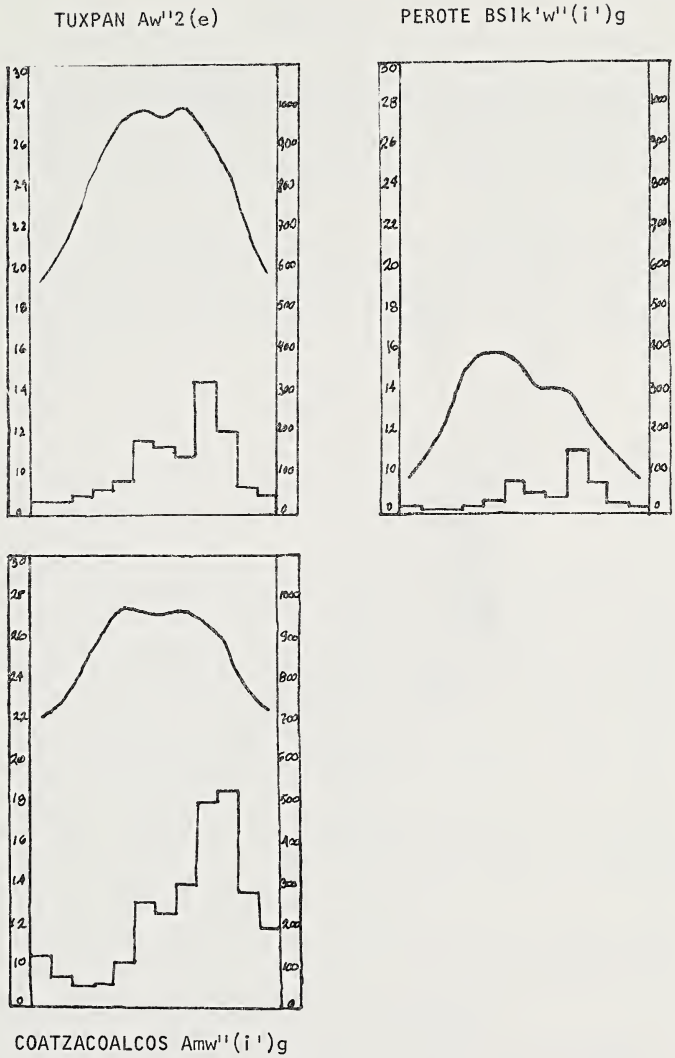

Fig. 2. Comparative temperature and precipitation at three stations representing the North Veracruzan District (Tuxpan), the South Veracruzan District (Coatzacoalcos), and the Sierra Madre Oriental barrier (Perote) between them.

Fig. 3. Isobars of days of frost per year (after Soto, 1969).

Vegetation

The general features of the vegetation have been amply studied and summarized by Gómez-Pompa (1978). The vegetational regions are very diversified going from high jungles (in the low regions of Coatzacoalcos and in the Sierra de Los Tuxtlas) and pine woods (in the high regions of the Sierra Madre Oriental), to a variety of associations including the gum-oak forest (Huatusco and Orizaba), the savannah (at Las Choapas), mangrove (Sontecomapan and Coatzacoalcos), palms and dunes (in the coastal region), etc.

Gómez-Pompa (*op. cit.*) reviews the change in the types of vegetation from the Sierra Madre mountains (in Teziutlán, Puebla), to the Gulf coast (Nautla), along parallel 20°. The succession goes from *Liquidambar* woods in the high regions, to *Pinus strobus* woods, tropical rain forest, oak woods and finally mangrove in the coastal regions.

Faunal Analysis

We have pointed out the natural division of the coastal plain of the state of Veracruz by an orographic barrier located exactly at 19°50' N and 96°25' W. This orographic character imposes consequences on the vegetation and the climate and, therefore, on the fauna

This area forms a strait which is hardly wider than one kilometer, along several kilometers and through which the southern and northern Llanura Costera communicate (Hall and Dalquest, *op. cit.*:173). North of this critical area lies what we consider the North District of the Veracruzan Province, including northern Veracruz, the low regions of San Luis Potosí (Xilitla, Tamazunchale) and southeastern Tamaulipas, all with neotropical influence as already observed by Alvarez (1963:373).

The South District includes, fundamentally, southern Veracruz, the low regions of northern Oaxaca, a fraction of the Isthmus of Tehuantepec, the basin of the Coatzacoalcos river and the low regions of Tabasco.

In order to analyze the degree of similarity, the Simpson equation was used, expressed as follows: $SV = 100\ C/(N_1 + N_2 - C)$, where SV is the similarity value in percentage; C is the number of taxa common to both districts; N_1 is the number of taxa in the district with the lowest number of species; and N_2 is the number of taxa in the district with the highest number of species.

This equation has been used by various investigators to establish the limits of the Biotic Provinces (Barrera, 1962; Alvarez, *op. cit.*; Ryan, 1963) and, even though it is usually used in faunas where N_1 and N_2 are similar, we have utilized it in order to make comparisons with the studies above mentioned.

This equation is here applied only to reptilian and mannalian taxa since they are the ones for which we have the greatest personal collection data and the most complete bibliographic information.

In our analyses the scientific trinomial name has been taken into consideration because the criterion of subspecies is normally used in the determination of a Faunistic District (Barrera, *op. cit.*). Likewise, only the reptiles and mammals occurring in the coastal plain of Veracruz, with a range of altitudes of 0 to 300 meters, have been included in the analysis, automatically excluding the taxa of the high regions of the Sierra Madre Oriental, the Sierra de Tantima and Sierra de Los Tuxtlas.

Class Reptilia

In this group of vertebrates, the similarity value of the two districts is 32.2% - notibly low if it is considered that the value of 50% is sufficient, in some cases, to establish a Faunal District (see Barrera, *op. cit.*). The taxa serving for this calculation are basically those listed for the low regions of Veracruz by Smith and Taylor (1945 and 1950), and by Pérez-Higareda (1978a and 1978b), excluding those of the regions with elevations higher than 300 meters above sea level

In the North District occur some species not yet found in the South, beyond the region of Palma Sola, such as the turtles *Kinosternon f. flavescens* and *Terrapene carolina mexicana*, and the snake *Pliocercus bicolor*.

In the South District there is a greater influence of neotropical species, with 35 species; and, although there are 17 species common to both Districts, 3 of them are represented by different subspecies (6 in all, see Table 1) delimited geographically by the barriers of the Sierra Madre Oriental and the region of Palma Sola.

Particularly pronounced are the subspecies *Pseudemys scripta cataspila* and *P. s. venusta*, both located in the coastal plain at elevations lower than 300 meters above sea level, but separated from each other in the Palma Sola region, where only portion of land with plain characteristics is furrowed by the Platanal and Palma Sola harbour-bars, whose rivers near the littoral contain a great proportion of brackish water (see Figure 4).

Class Mammalia

For the analysis of mammals, we have used data by Hall and Dalquest (*op. cit.*), Villa (1966), Hall and Kelson (*op. cit.*) and Navarro y Martínez (1979, in prep.). All the mammals of the low regions have been included, omitting the aquatic and those introduced by man.

The SV obtained is 29.9%, in comparison of the North and South Districts. This value is very low, inferior to the 33% mentioned by Barrera (*op. cit.*) to separate, biogeographically, the Yucatán Peninsula from the Petén Province; and Ryan (*op. cit.*), in his delimitation of the Biotic Provinces of Central America, finds that the lowest values are 28%, but a value of 40-50% is used to separate one Biotic Province from other.

However, the SV obtained for mammals in this study is biased since $N_1 = 49$ and $N_2 = 103$, hence rather dissimilar, but it is obvious that the value is rather low and similar to the one obtained for the reptiles.

The taxa are distributed in the two Faunistic Districts as summarized in Table II. In the North District are 49 subspecies, among which the following can be considered typical: *Lasiurus seminolus, Sciurus deppei negligens, Nycticeus humeralis mexicanus, Lyomys irroratus pretiosus*. In the South District *Heteromys lepturus, Alouatta villosa* and *Eira barbara* are notable examples.

Conspicuously common to both Districts are *Philander opossum pallidus, Cynomops malagai* and *Sciurus deppei deppei*.

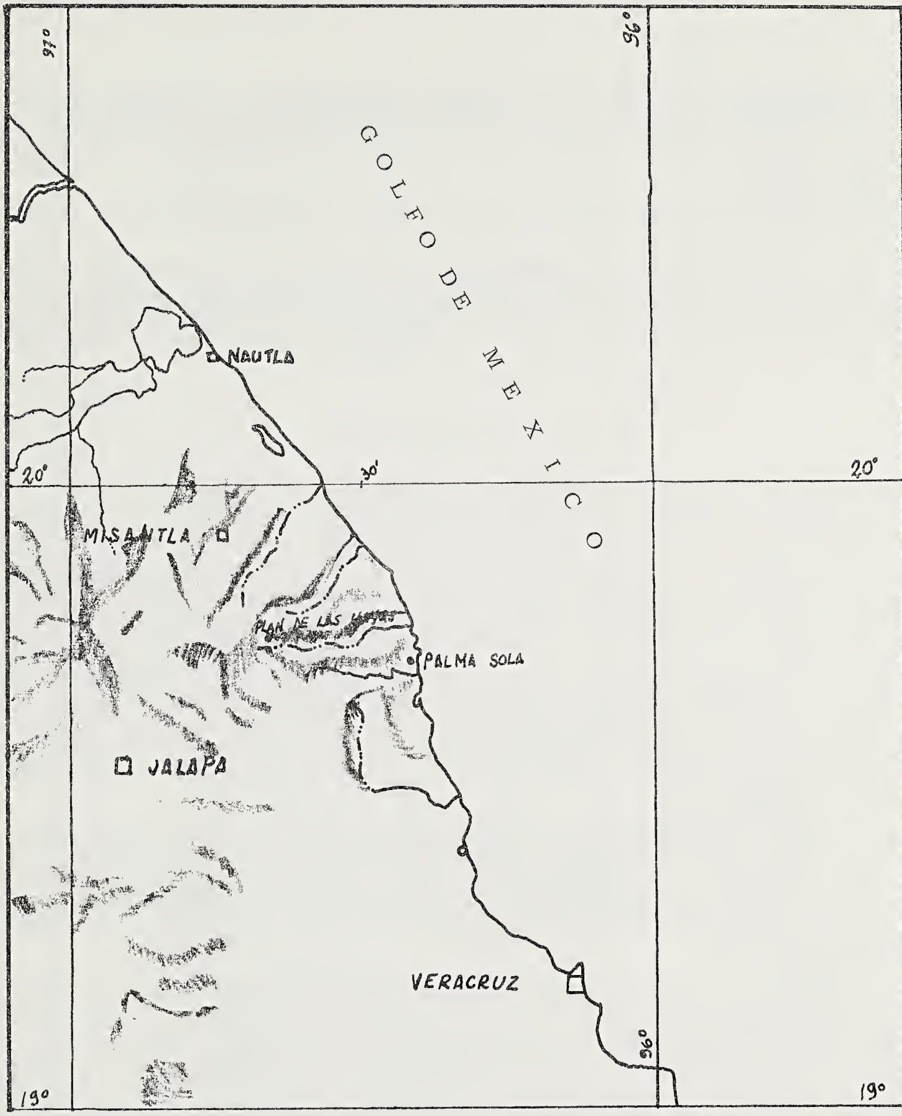

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Fig. 4. Diagram of minor elevations of the eastern arm of the Sierra Madre Oriental, where it acts as a barrier between the North and South Veracruz Districts. The coastal strait is permeated by a brackish river net.

The Palma Sola barrier separates two species of *Liomys: L. irroratus* and *L. pictus*. The following species form different subspecies, starting from the orographic barrier: *Oryzomys couesi, Nasua narica, Felis yagouaroundi, Mustela frenata* and *Heterogeomys hispidus*.

The influence of this barrier is less apparent in the Chiroptera due, surely, to its flight ability.

We regard the correlation of mammalian distribution with the number of frost days a year as a first order factor, because since the mammals have neotropical affinities, they lack, as a general rule, the adaptations, such as hibernation, dense pelage, etc., which are characteristic of organisms adapted to cold climatic conditions.

Discussion and Conclusions

On the basis of analysis of quantitative data on reptiles and mammals of the low plains of Veracruz, we have reached the conclusions that two Faunistic Districts exist, here designated the North Veracruzan and South Veracruzan Districts (Figure 5).

For said analysis, the formula of similarity value (SV) has been used, whose utility in studies of zoogeographic type is ample, notwithstanding some inherent limitations. The values obtained (32.3% and 29.9%, for the Reptilia and Mammalia, respectively) show a low level of similarity justifying the designation of Districts.

The transition area of these two Districts is located near Palma Sola, Veracruz, and is an orographic barrier (close approximation of the Sierra Madre Oriental to the sea), hydrological barrier (an extensively brackish fluvial net from the Sierra Madre Oriental), a climatic barrier (frost days, low temperature and heavy rainfall), and a vegetational barrier (a drastic shift correlated with coastal dunes, from more mesic to more zeric types).

The influence of this composite barrier on the fauna is particularly conspicuous in the case of *Pseudemys scripta* (Reptilia: Testudines), since *P. s. cataspila* occurs to the north of it, *P. s. venusta* to the south. Equally impressive is the separation of two species of *Liomys* (Mammalia: Rodentia), *L. irroratus* occurring northward, *L. pictus* southward. This barrier delimits a total of 12 subspecies of reptiles and 10 of mammals.

In proposing two Faunal Districts in the low regions of Veracruz it is necessary to note the existence of a third District in the Veracruzan Biotic Province, in the Sierra de Los Tuxtlas, as proposed by Firschein and Smith (1956). The Los Tuxtlas zone, whose gradë of endemism is high, was designated as a Faunal District called "Catemacan", based on its physiographic and biological particularities. It is characterized by a vein of basaltic rocks, of a different geological origin from that of the coastal plains. Likewise, there is a range of altitude from 0 to 1,700 meters, presenting a very abrupt topography. Its soil has abundant pyroclastics and volcanic ash (Andrle, 1964; Sousa, 1963). The Los Tuxtlas region is also distinctive climatically, with areas having the highest rainfall in the state, reaching to over 4,000 mm a year.

Fig. 5. Map of the three Faunal Districts of the Veracruzan Biotic Province.

As Firschein and Smith (*op. cit.*) have pointed out, this region is rich in endemic species, the most important ones being *Micrurus limbatus*, *Lepidophyma pajapanense* (Reptilia), *Cryptotis nelsoni* and *Heteromys lepturus* (Mammalia). More detailed studies on the reptiles of the Los Tuxtlas region can be found in Pérez-Higareda (*op. cit.*) and on mammals in Navarro *et al.* (*op. cit.*).

Accordingly, the Veracruzan Biotic Province is represented by 3 Faunistic Districts: The North District, the South District and the Catemacan District, whose limits are indicated in Figure 5. Similar analyses of other regions of Mexico are in urgent need as an essential prelude to the understanding and conservation of the Biotic Provinces of Mexico.

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Table 1. Comparison of the Reptiles of the Lowland Districts of Veracruz

<u>District North</u>

Kinosternon F. flavescens

Terrapene Carolina mexicana

Pliocerus bicolor

<u>District South</u>

Dermatemys mawei

Chelydra serpentina rossignoni

kinosternon acutum

Kinosternon l. leucostomum

Claudius angustatus

Staurotypus triporcatus

Rhinoclemys areolata

Anolis tripidonotus

Anolis lemurinus bourgeaei

Corytophanes hernandezii

Corythophanes cristatus

Sceloporus teapensis

Lepidophyma f. flavimaculata

Cnemidophorus g. guttatus

Adelphicos q. quadrivirgatus

Conophis l. lineatus

Dendrophidion vinitor

Drymobius chloroticus

Ficimia publia

Imantodes cenchoa leucomelas

Imantodes splendidus lucidorsus

Lampropeltis triangulum polyzona

Leptophis occidentalis praestans

Ninia diademata nietoi

Ninia diademata diademata

Ninia sebae sebae

Pseustes poecilonotus argus

District South (continued)

Rhadinaea decorata
Sibon nebulatus
Stenorrhina degenhardti mexicana
Tantilla phrenitica schistosa
Xenodon mexicanus
Micrurus diastema sapperi
Micrurus e. elegans

Species common to both Districts

Kinosternon herrerai
Kinosternon scorpioides cruentatum
Anolis sericeus
Laemanctus serratus
Basiliscus vittatus
Sceloporus serrifer plioporus
Eumeces tetragrammus
Cnemidophorus deppei
Boa constrictor
Elaphe f. flavirufa
Leptophis m. mexicanus
Masticophis m. mentovarius
Oxybelis aeneus
Spilotes pullatus mexicanus
Nerodia rhombifera blanchardi
Bothrops atrox

Subspecies separated by strait of Palma Sola

District North	District South
Pseudemys scripta cataspila	Pseudemys scripta venusta
Cnemidophorus sackii gularis	Cnemidophorus sackii communis
Coniophanes imperialis imperialis	Coniophanes imperialis clavatus
Drymarchon corais erebennus	Drymarchon corais melanurus
Pliocercus elapoides celatus	Pliocercus elapoides elapoides
Ficimia olivacea streckeri	Ficimia olivacea olivacea

Table 2. Comparison of the Mammals of the Lowland Districts of Veracruz

North District

Didelphis marsupialis californica
Lasiurus seminolus
Nycticeus humeralis mexicana
Sciurus deppei negligens
Liomys irroratus pretiosus
Peromyscus leucopus mesomelas
P. maniculatus fulvus
Baiomys t. taylori

South District

Didelphis marsupialis tabascensis
Caluromys derbianus aztecus
Cryptotis micrura
Rhynchonycteris naso
Saccopteryx bilineata
Peropteryx k. kappleri
Centronycteris maximiliani
Balantiopteryx p. plicata
B. io
Diclidurus virgo
Noctilio leporinus
Pteronotus parnellii mesoamericanus
P. personatus psilotis
P. davyi fulvus
P. gymnonotus
Mormoops m. megalophylla
Micronycteris brachyotis
Mimon cozumelae
Phyllostomus discolor verrucosus
Trachops cirrhosus coffini
Chrotopterus a. auritus
Vampyrum spectrum
Hylonycteris underwoodi
Choeroniscus godmani
Leptonycteris n. nivalis
Carollia castanea
Uroderma bilobatum molaris
Vampyressa pusilla thyone
Chiroderma villosum jesupi
Artibeus t. toltecus
A. p. phaeotis
A. watsoni
Myotis fortidens
M. nigricans extremus
M. argentatus
Pipistrellus subflavus seraecrucis
Molossus ater nigricans
Alouatta villosa
Ateles geoffroyi vellerosus
Tamandua tetradactyla mexicana
Cyclopes didactylus mexicanus
Dasypus novemcinctus mexicanus
Liomys pictus veraecrucis
Heteromys lepturus
Heteromys temporalis
Oryzomys alfaroi palatinus
Tylomys nudicaudus gymnurus
Nyctomys s. sumicharasti
Baiomys m. musculus
Coendou mexicanus
Agouti paca nelsoni
Dasyprocta mexicana
Eira barbara senex
Galictis allamandi canaster

South District (continued)

Mephitis macroura eximius
Conepatus semistriatus
Lontra longicaudis annectens
Felis concolor mayensis
Felis pardalis pardalis
Felis wiedii oaxacensis
Tapirus bairdii
Tayassu pecari
Mazama americana temama

Species common to both Districts

Philander opossum pallidus
Marmosa mexicana mexicana
Cryptotis parva pueblensis
Pteronotus parnelli mexicanus
Carollia perspicillata azteca
Sturnira lilium parvidens
Artibeus jamaicensis yucatanicus
Artibeus lituratus intermedius
Glossophaga soricina leachii
Desmodus rotundus murinus
Natalus stramineus saturatus
Eptesicus brasiliensis propinquus
Rhöogeesa t. tumida
Sylvilagus brasiliensis truei
Sylvilagus floridanus connectens
Sciurus deppei deppei
Sciurus aureogaster aureogaster
Heterogeomys hispidus torridus
Liomys pictus obscurus
Oryzomys melanotis rostratus
O. f. fulvescens
Peromyscus m. mexicanus
P. leucopus incensus
Reithrodontomys m. mexicanus
R. fulvescens tropicalis
Sigmodon hispidus toltecus
Canis latrans cagottis
Urocyon cinereoargenteus orinomus
Procyon lotor hernandezii
Felis onca veraecrucis
Trichechus manatus latirostris
Dicotyles tajacu crassus
Odocoileus virginianus veraecrucis

Subspecies separated by Strait of Palma Sola

District North	District South
Oryzomys couesi peragrus	Oryzomys c. couesi
Nasua narica molaris	Nasua n. narica
Felis yagouaroundi cacomitli	Felis yagouaroundi fossata
Heterogeomys hispidus latirostris	Heterogeomys hispidus isthmicum
Mustela frenata tropicalis	Mustela frenata perda

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REPTILES AND AMPHIBIANS IN THE VICINITY OF VIENNA, MARYLAND

Robert H. Johnson and Marie Van Deusen

Reptiles and amphibians in the vicinity of Vienna, Dorchester County were surveyed from summer 1978 through spring 1979. This field survey was part of a larger ecological survey of the area conducted in consideration of expansion of the Delmarva Power and Light Vienna Steam Electric Station (Van Deusen and Otto 1979). The survey attempted to (1) identify habitats that might be especially favorable for herptiles; (2) compile a species inventory of reptiles and amphibians in the study area; and (3) assess the potential presence or absence of two amphibians (eastern narrow-mouthed toad and eastern tiger salamander) previously reported from Dorchester County, which are endangered in Maryland (Maryland Department of Natural Resources 1975).

The survey site lies on the Eastern Shore of the Chesapeake Bay, west of the Nanticoke River and north of U.S. Route 50 and the town of Vienna (Figure 1). The approximately 787 ha of land surveyed included ~31 ha occupied by the existing steam electrical generating plant, ~396 ha of primarily forested area lying west of Maryland Route 331 and ~360 ha of primarily agricultural land lying east of Route 331. The forested area has a high water table and a large number of ephemeral ponds occur here seasonally. East of the highway there are also small amounts of old-field habitat along a right-of-way and brackish marsh and wooded swamp bordering the Nanticoke River and Chicone Creek. Two permanent ponds occur in the area.

Previous surveys have reported 4 species of salamander, 13 species of anurans, 3 species of lizards, 11 species of snakes and 8 species of turtles in Dorchester County (Harris 1975).

Methods

Our study commenced with a broad habitat survey of the area, conducted on foot, to locate "particularly likely" herptile habitats. These areas were then intensively searched at approximately 4-6 week intervals, although not to the exclusion of other less-likely areas. Standard herpetological search techniques were employed -- turning over stones and logs, raking through leaf litter, seining ponds (for tadpoles and caudate larvae), removing bark from dead trees, picking through rotted logs, and searching likely basking sites for snakes and turtles. On Chicone Creek, a canoe was used to investigate shorelines and low branches for basking reptiles. On every site visit, 2-6 hours were spent in listening for calling frogs (followed by capture for positive identification, if necessary). All roadkills were carefully examined.

Animals were identified primarily by visual inspection of adults, although eggs and larvae were identified in season and many species of frogs and toads were recognized by voice, particularly in spring and summer. Conant (1975) and Smith (1978) were used to confirm species identifications and as nomenclatural authorities.

Fig. 1. Map of the Vienna survey site with approximate area included in the study outlined. Forests are stippled; marsh is designated by marsh symbol. Solid white areas within boundary are cultivated lands; old-field occupies the railroad right-of-way and road edges.

Results and Discussion

We encountered one species of salamander, 8 species of anurans, 2 species of lizards, 3 species of snakes and 4 species of turtles (Table 1), which represents 53% of the county's amphibians and 41% of the county's reptiles. Table 1 also lists habitats in which species were found, seasons in which they were encountered and an estimate of relative abundance.

Amphibians: The only salamander encountered was the red-backed salamander (*Plethodon c. cinereus*), and both color phases were equally abundant. This species was found in all wooded areas, but was most prevalent in the wet woods to the west of Rte. 331. Typical habitat was in or under rotting logs. The four-toed salamander (*Hemidactylus scutatum*) was not found, despite the fact that appropriate habitat (low wet woods with an abundance of *Sphagnum*) exists on much of the property. The many ephemeral woodland ponds of the mixed deciduous-pine woods west of Rte. 331 were not used for breeding by either marbled or spotted salamanders (*A. opacum* and *A. maculatum*).

A particular effort was made to assess possible presence of the eastern tiger salamander (*Ambystoma t. tigrinum*) on the site because of its endangered status in Maryland. The first record of this species in Maryland comes from Vienna in 1933, where it reportedly was recovered from under debris "near a water works in Vienna" (Netting 1938). Despite extensive searching of the area and many questions to local residents, we have been unable to locate said waterworks, appropriate breeding habitat or specimens of tiger salamanders. Late winter-early spring efforts focused especially on searching for the distinctive egg masses of this species, but none were found either on the study site or in any temporary or permanent pond in the area.

Several species of anurans were frequently encountered: Fowler's toad (*Bufo woodhousei fowleri*), spring peeper (*Hyla crucifer*), New Jersey chorus frog (*Pseudacris triseriata kalmi*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*) and southern leopard frog (*Rana u. utricularia*). One adult pickerel frog (*Rana p. palustris*) was captured on mud flats of Chicone Creek at low tide, and egg masses of the wood frog (*Rana s. sylvatica*) were found on the study site. (Van Deusen and Johnson 1979). This last species had not been previously recorded from Dorchester County although its distribution includes all surrounding counties (Harris 1975).

Conspicuously absent from the list of species encountered are the northern cricket frog (*Acris c. crepitans*), green treefrog (*Hyla cinerea*) and eastern grey treefrog (*Hyla v. versicolor*). Appropriate habitat for these usually ubiquitous species occurred on the site. Also absent were the eastern narrow-mouthed toad (*Gastrophryne carolinensis*), the carpenter frog (*Rana virgatipes*) and the eastern spadefoot toad (*Scaphiopus h. holbrooki*). The narrow-mouthed toad is know from western Dorchester County and presumably the Vienna area falls within its range, but it is a rare and secretive animal, listed as endangered in Maryland. Similarly, the carpenter frog is not common in the state. On the other hand, the spadefoot toad is often abundant, where it occurs, after heavy rains in summer. The fact that no site visits coincided with these conditions may account for our failure to find this species.

Reptiles: The reptile fauna of the Vienna property was surprisingly sparse. While five-lined skinks (*Eumeces fasciatus*) were commonly encountered (under bark or basking), only one specimen of the ground skink (*Scincella lateralis*) was found. The only other skink known from Dorchester County, the broad-headed skink (*Eumeces laticeps*), was not encountered.

Several species of turtles were found on the property. Many shells of box turtles (*Terrapene c. carolina*) were seen, although no living specimens were ever found. In Chicone Creek and the other waterways of the property, snapping turtles (*Chelydra s. serpentina*), eastern painted turtles (*Chrysemys p. picta*) and redbellied turtles (*Chrysemys rubriventris*) were seen swimming or basking. These three species appear to be common on the site. Spotted turtles (*Clemmys guttata*) and mud turtles (*Kinosternon s. subrubrum*) were not seen, nor was the diamondback terrapin (*Malaclemys t. terrapin*) found, although it probably occurs in the lower marshes where Chicone Creek meets the Nanticoke. Local people report that this last species is still harvested and sold in the area. Stinkpots (*Sternotherus odoratus*) were not seen.

Although Harris (1975) reported 11 species of snakes from Dorchester County, we found only 3 species on or near the study area. Water snakes (*Natrix s. sipedon*) were commonly seen near Chicone Creek, and two juvenile black rat snakes (*Elaphe o. obsoleta*) were found, one sunning in a tree over 6 feet off the ground. Worm snakes (*Carphophis a. amoenus*) were frequently found in rotting logs.

Several species are presumed to occupy the site, although they were not seen. These include the garter snake (*Thamnophis s. sirtalis*), ribbon snake (*Thamnophis s. sauritus*), northern ringneck (*Diadophis punctatus*), black racer (*Coluber c. constrictor*) and northern brown snake (*Storeria d. dekayi*). In addition, it is possible that the hognose snake (*Heterodon platyrhinos*), rough green snake (*Opheodrys aestivus*) and eastern king snake (*Lampropeltis g. getulus*) inhabit the area. It is more difficult to comment on the probability of occurrence of the corn snake (*Elaphe g. guttata*) or red-bellied water snake (*Natrix e. erythrogaster*) on the property. Despite the apparent impoverishment of Vienna ophidiofauna (27% of known Dorchester County species), this may be merely an artifact of our failure to sample extensively in summer, when snakes are most commonly encountered.

Despite the amount of field time invested at the Vienna site, we were able to list fewer than half the total species known from Dorchester County. And, unfortunately, our field efforts were not uniformly distributed throughout the year. These results quite eloquently underscore the roles that when, where and how much one sample plays in analyses of natural distributions and abundance of species.

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Support of the Maryland Power Plant Siting Program, Detailed Site Evaluation Section (Dr. Robert G. Otto, Chesapeake Bay Institute, Principal Investigator) is gratefully acknowledged. The advice of Mr. Herbert Harris and the typing of Ms. Shirley Sult and Cindy Fitzgerald are also appreciated.

Table 1. Amphibians and reptiles found in the vicinity of the proposed power station site at Vienna, with comments on relative abundance and habitat. Taxonomy from Conant (1975).

Order (O.) Family (F.) Species	Common Name	Relative Abundance[1]	Habitat	Season
AMPHIBIANS				
O. Caudata				
F. Plethodontidae				
Plethodon c. cinereus	Red-backed salamander	Abundant	Woody detritus	All
O. Anura				
F. Bufonidae				
Bufo woodhousei fowleri	Fowler's toad	Abundant	Ubiquitous	All
F. Hylidae				
Hyla c. crucifer	Northern spring peeper	Common	Temporary and permanent ponds	Spring
Pseudacris triseriata kalmi	New Jersey chorus frog	Common	Temporary and permanent ponds	Spring
F. Ranidae				
Rana catesbeiana	Bullfrog	Abundant	All water bodies	Primarily summer
Rana clamitans melanota	Green frog	Common	All water bodies	Spring
Rana u. utricularia	Southern leopard frog	Common	All water bodies	Spring
Rana palustis	Pickerel frog	Uncommon→ Common	Chicone Creek	Spring
Rana sylvatica	Wood frog	Common	Temporary ponds (eggs and tadpoles)	Spring

Table 1. (continued)

Order (O.) Family (F.) Species	Common Name	Relative Abundance[1]	Habitat	Season
REPTILES				
O. Squamata				
F. Scincidae				
Scincella laterale	Ground skink	Rare	Woody detritus	Summer, Fall
Eumeces fasciatus	Five-lined skink	Abundant	All fields and woods	All
F. Colubridae				
Natrix s. sipedon	Northern water snake	Abundant	Chicone Creek	All
Carphophis a. amoenus	Eastern worm snake	Common	Rotting logs	Fall, Spring
Elaphe o. obsoleta	Black rat snake	Common	Ubiquitous	Fall
O. Testudines				
F. Chelydridae				
Chelydra s. serpentina	Common snapping turtle	Common	All water bodies	Spring
F. Emydidae				
Terrapene c. carolina	Eastern box turtle	Common	All fields and woods	All
Chrysemys p. picta	Eastern painted turtle	Uncommon	Permanent ponds	Spring
Chrysemys rubriventris	Red-bellied turtle	Common	Chicone Creek	All

[1]Abundant = found in large numbers
Common = found in fairly large numbers and/or frequently encountered
Uncommon = found in small numbers and/or infrequently encountered
Rare = single sightings

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NEWS & NOTES

A N N O U N C I N G   T H E   P U B L I C A T I O N

OF

IDENTIFICATION GUIDE TO PENNSYLVANIA SNAKES

BY DR. C. J. McCOY, illustrated by Michael Antonoplos

April, 1980

Published by the Benedum Resource Project, Section of Education,

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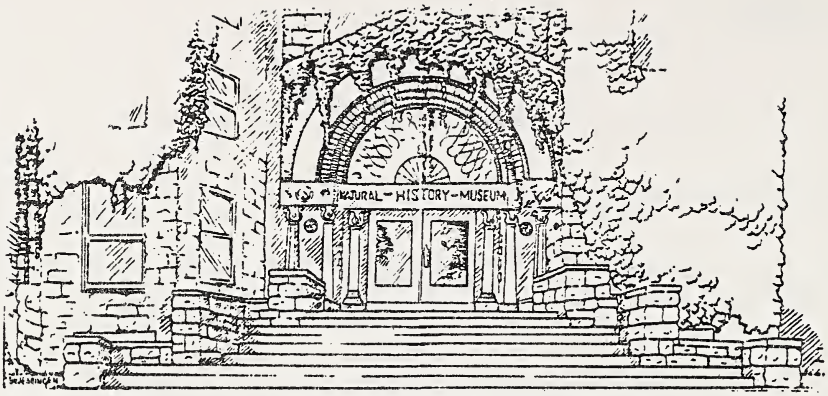

Edward Harrison Taylor 23 April 1889 - 16 June 1978

Dr. Edward H. Taylor pioneered scientific research in all parts of the world including North America, Central and South America, Africa, Mexico, Southeast Asia, Indonesia, and the Phillippines.

Few monographs exist on amphibians and reptiles that do not cite the work of Edward H. Taylor. So, in tribute to this noted herpetologist, the University of Kansas Museum of Natural History has published:

EDWARD H. TAYLOR: RECOLLECTIONS OF AN HERPETOLOGIST

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Remaining copies are now available at the special price of $4.00!

The University of Montana Student Chapter of The Wildlife Society will sponsor the Fourth Annual International Wildlife Film Festival in the spring, 1981. We initiated the Festival to encourage film makers to produce better wildlife films, both in technical quality and content. Such films are essential in teaching ecological and environmental concepts to the public. These films may be the only contact many people have with wildlife, and so the messages they convey are critical.

The deadline for submission of applications and films is March 14, 1981. All entries must have a predominantly wildlife theme and have been produced or released during calendar year 1980. Judging will be held prior to the Festival. A panel of highly qualified film makers, humanists and biologists will judge both amateur and professional categories of wildlife films. Winning entries will receive certificates and the results will be internationally publicized.

The winning films will be shown to the public on April 10, 11, and 12,1981, at the University of Montana campus in Missoula. Panels and workshops of film makers and biologists will also be a feature during this weekend, along with an art exhibit of wildlife paintings and photos.

Information, rules of eligibility, application forms, and the Festival agenda can be obtained by writing or calling:

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WILLIAM E DUELLMAN

Editor

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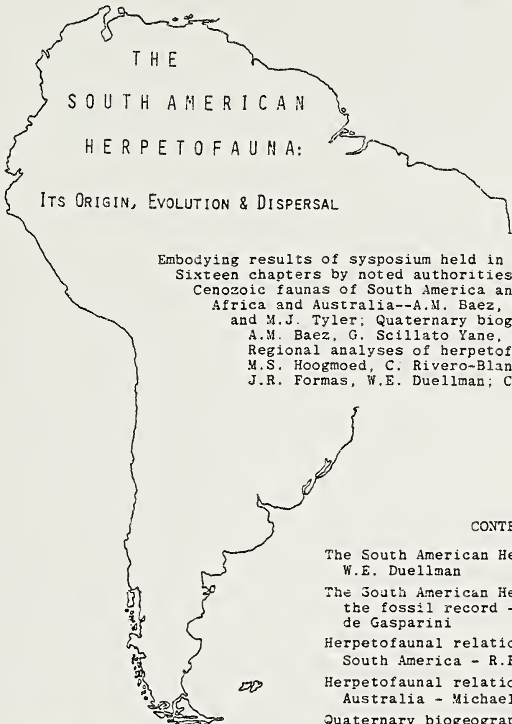

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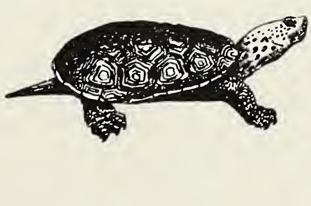

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September 1980 Volume 16 Number 3

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 16 SEPTEMBER 1980 NUMBER 3

THE LIZARD *ABRONIA DEPPEI* (SAURIA; ANGUIDAE) IN THE STATE OF MEXICO, WITH THE RESTRICTION OF ITS TYPE LOCALITY

Oscar Sánchez-Herrera and William López-Forment C.

The presence of *Abronia deppei* north of the Balsas River Basin is documented, and the type locality of the species is restricted to Temascaltepec-Real de Arriba, State of Mexico.

Abronia is a genus of Central American sauria particularly difficult to study due to its almost strictly arboreal and secretive habits, as well as its apparently low population density.

Abronia deppei Wiegmann, 1828, is one of the best known species in the genus, despite having been collected only occassionally in the State of Guerrero. Bogert and Porter (1967) recorded 6 specimens present in four American Museums: Mus. Comp. Zool. no. 33750 and Amer. Mus. Nat. Hist. no. 72543 from Chilpancingo; U.S. Nat. Mus. no. 113172, Mus Comp. Zool. nos. 42716 and 85248, C.N.H.M. (sic) no. 105600, all from Omilteme. These are in addition to the type and cotypes in the Zoologischen Museum of Berlin (nos. 1149, 1150 and 1151 respectively).

One of us (WLF) collected one specimen on 11 May 1980, 1 km SSW Valle de Bravo, State of Mexico. This lizard is undistinguishable from the type specimens of *A. deppei* as described by Wiegmann (1828 and 1834), and redescribed by Bocourt (1878). When it was compared to the Chilpancingo and Omilteme material we were again unable to find significant differences; thus, all specimens are assignable to the monotypic

species *A. deppei* (see Table 1).

COMPARED CHARACTERS	OMILTEME - CHILPANCINGO (n=6)	VALLE DE BRAVO (n = 1)
No. of anterior temporals	3, rarely 4	3
Temporals reaching postoculars	1	1
Anterior supercilliary separated from loreocanthal	usually variable	yes
Suboculars	2 (variable?)	1
Supralabial reaching orbit	penultimate	penultimate
Postmentals	2	2
Fewest nuchal scutes in any row	6	6
Whorls of scales on unregenerated tail	79(77-81)	78
No. of transversal scale rows from first nuchal to posterior insertion of leg	26.7(26-28)	27

Table 1. Comparison between *Abronia deppei* from the Sierra Madre del Sur of Guerrero and from the Sierra de Temascaltepec, State of Mexico.

(Data for Omilteme-Chilpancingo, Guerrero after Bogert and Porter, 1967; except suboculars taken from Bocourt, 1878).

The specimen here reported aroused our interest in view of Bogert and Porter's (1967) opinion concerning the supposed absence of *Abronia* north of the Balsas River Basin. These authors stated that its absence could be related to the apparent scarcity of epiphytes, which in turn may be caused by the lack of an adequate moisture supply. On the other hand, they conjectured that the "northward dispersal of *Abronia* was halted by disjunctions in the forested areas or the increasing paucity of epiphytes." But there is one fact that Bogert and Porter seem to have overlooked; the Balsas River Basin has an arrangement of moderately high mountains at its western portion, where ash-oak or pine-oak forest with epiphytes occur.

These mountains, as well as those of the Cordillera Volcanica Transversal were formed in early Pliocene times, and if one considers Udvardy's (1969) idea that, theoretically, the life-span of the morphological characters of a species can approach one to one and half million years, one could believe that *Abronia* occupied both these mountain areas just before the Balsas River Basin began to play its present role as a barrier, splitting the population. The striking phenotypical coincidence of the two known populations may be explained by Stebbins' (1971) statement that when the environment in two or more recently separated areas exerts similar selective pressures on the organisms of each disjunct population of the same species, the morphology may remain practically unchanged. A parallel situation has been dealt with by Myers (1974) on the distribution of the snakes *Rhadinaea t. taeniata* and *Rhadinaea taeniata aemula*.

The habitat of Valle de Bravo can be defined as highly suitable for *Abronia*; the trees are covered with plenty of bromeliads, mosses, lichens and even epiphytic cacti, which provide adequate shelter and food. These animals seem to live near clearings of the forest or near its edges as indicated by the single specimen and a shed skin, collected later in a nearby area. A tendency for climbing high up the trees is presumed because the shed skin was discovered hanging among thin branches 3 m above ground. The live specimen however, was taken near the base of a tree.

When Wiegmann's descriptions appeared (1828 and 1834) as well as when Bocourt (1878) redescribed the species, the precise locality where the type and cotypes were collected

was unknown (Bocourt states only 'Mexico'). Smith and Taylor (1950 restricted the type locality of the species to Omilteme, State of Guerrero, where the majority of the specimens have been obtained. However, as Taylor (1969) has stated, "All of Wiegmann's material was obtained in Mexico by German collectors. Ferdinand Deppe.....collected most of the material on two separate trips." Stresseman (1954) points out that F. Deppe never traveled in the State of Guerrero. Abundant material, however, was obtained by him near Temascaltepec and Real de Arriba, both in the State of Mexico (see also Sibley and Davis, 1946).

Thus, as the type specimens of *A. deppei* were collected by Deppe himself, they came from the State of Mexico and not from Guerrero. As Temascaltepec and Real de Arriba are two localities only 18 km SSE from Valle de Bravo, we regard Temascaltepec-Real de Arriba as the appropriate type locality for *Abronia deppei*.

Acknowledgments

We are indebted to M.S. Rafael Martín del Campo who loaned us some critical historical literature.

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REPTILES AND AMPHIBIANS OF SELECTED LAKE ERIE STREAMS IN NORTHWESTERN PENNSYLVANIA

Donald M. McKinstry and Harry N. Cunningham, Jr.

ABSTRACT

The occurrence of reptiles and amphibians inhabiting selected Lake Erie streams in northwestern Pennsylvania was surveyed. Three species of snakes, five species of frogs and toads, and six species of salamanders were observed. Data as to abundance and habitat are presented.

In northwestern Pennsylvania a number of shale-bottom streams meander through woodland areas and fields. These streams enter the southern side of lake Erie. During the summer and autumn of 1974 and the spring of 1975, we conducted a survey of the reptiles and amphibians inhabiting some of these streams and their flood plains. The purpose of this this survey was to supply information to the Northwestern Pennsylvania Environmental Data Center. This base-line data may be useful in the formulation of future environmental impact statements.

Collection sites representing the mouth regions, mid regions, and upper regions of selected streams were chosen. Each site is approximately 200-500 m long. The name, location, and nature of each site is as follows: Site A, Four Mile Creek mouth region, Lawrence Park, golf course; Site B, Four Mile Creek mid region, Behrend College campus, woodland gorge; Site C, Four Mile Creek upper region, above Hartman Rd., field with brush and trees; Site D, Six Mile Creek mouth region, Cowell residence near Rt. 5, woodland; Site E, Six Mile Creek mid region, Hannon Rd. below Rt. 90, woodland gorge; Site F, Six Mile Creek upper region, Depot Rd., woodland; Site G, Eight Mile Creek mouth region, Shades Beach, woodland; Site H, Eight Mile Creek mid region, King Rd., open field and brush; Site I, Eight Mile Creek upper region, Rohl Rd., woodland; Site J, Twelve Mile Creek mouth region, Moorehead Rd., open grassy area; Site K, Twelve Mile Creek mid region, Penn Central railroad tracks, open grassy area; Site L, Sixteen Mile Creek mouth region, Orchard Beach, open area with houses; Site M, Sixteen Mile Creek

upper region, Smith Reservoir, woodland; Site N, Twenty Mile Creek mouth region, Rt. 5, open area with houses; Site O, Twenty Mile Creek mid region, Penn Central railroad tracks, above Gage Gulf, woodland gorge (Note: In south-western New York).

All collecting trips were made in the daytime and involved both authors searching for about 1 hr. per site. Traditional collecting methods, i.e. search of logs, boards, and flat rocks as well as inspection of exposed stream banks and stream beds were employed.

The following species of snakes were the only reptiles observed: eastern garter snake, *Thamnophis sirtalis sirtalis;* northern water snake. *Nerodia sipedon sipedon;* northern ringneck snake, *Diadophis punctatus edwardsi.* Specifics as to numbers of specimens collected appear in Table 1. The eastern garter snakes and northern water snakes were usually observed on or under flat rocks in sunny areas along the streams. The northern ringneck snakes were observed under flat rocks which were overgrown with vines.

The following species of amphibians were observed: eastern american toad, *Bufo americanus americanus;* green frog, *Rana clamitans malanota;* pickeral frog *Rana palustris;* northern leopard frog, *Rana pipiens;* wood frog, *Rana sylvatica;* northern two-lined salamander, *Eurycea bislineata bislineata;* mountain dusky salamander, *Desmognathus ochrophaeus*/ northern dusky salamander, *Desmognathus fuscus fuscus* (species determination not made); spring salamander, *Gyrinophilus porphyriticus porphyriticus;* slimy salamander, *Plethodon glutinosus glutinosus*; redback salamander, *Plethodon cinereus cinereus*; northern red salamander *Pseudotriton ruber ruber.* Specifics as to numbers of specimens collected (approximations in some cases) appear in Tables 2 and 3. The frogs and toads were generally observed under/on flat rocks of the stream beds or along the stream banks. The salamanders were usually observed under flat rocks and decaying logs along and in the streams.

The three species of snakes and eleven species of amphibians reported in this survey are known to occur in northwestern Pennsylvania (Conant, 1975). Thus the survey does not add new information as to the range of these animals. However, the specific data presented in this report may be useful in evaluating the effect of any future alterations of the

Table 1. Reptiles observed in selected Lake Erie Stream areas during the summer and autumn of 1974 and the spring of 1975.

Number of Specimens Observed

Site No.	and Visits	*T.s. sirtalis*	*N.s. sipedon*	*D.p. edwardsi*
A	2	0	0	0
B	4	2	0	2
C	3	1	1	1
D	1	0	0	0
E	4	2	2	0
F	3	0	0	0
G	3	0	0	0
H	1	0	0	0
I	2	0	0	0
J	1	0	1	0
K	1	0	1	0
L	1	0	0	0
M	3	0	0	0
N	1	0	0	0
O	3	2	0	0
P	2	2	1	2

Table 2. Frogs and toads observed in selected Lake Erie stream areas during the summer and autumn of 1974 and the spring of 1975.

Number of Specimens Observed

Site and No. Vis.		*B.a. americanus*	*R. c. malanota*	*R. palustris*	*R. pipiens*	*R. sylvatica*
A	2	<10	0	0	0	0
B	3	8	9	0	0	6
C	2	0	0	0	0	0
D	1	0	0	0	0	0
E	3	0	0	0	0	0
F	3	5	0	0	0	25
G	3	0	0	0	0	0
H	0	-	-	-	-	-
I	2	0	0	0	0	0
J	1	0	0	0	0	0
K	0	-	-	-	-	-
L	0	-	-	-	-	-
M	3	1	0	1	0	1
N	1	0	0	0	0	0
O	3	0	0	0	<10	0
P	1	0	0	0	6	0

Table 3. Salamanders observed in selected Lake Erie stream areas during the summer and autumn of 1974 and the spring of 1975.

Site and	No. Visits	Number of Specimens Observed					
		E.b. bislineata	P. cinereus	P.r. ruber	G.p. porphyri-ticus	p.g. glutinosus	D.f. fuscus/ ochrophaeus
A	2	0	0	0	0	0	<10
B	3	0	15	0	0	0	50
C	2	<10	10	0	0	0	10
D	1	<10	0	0	0	0	0
E	3	15	0	1	0	0	<10
F	3	11	1	0	0	0	10
G	3	15	20	0	0	0	<10
H	0	-	-	-	-	-	-
I	2	0	0	0	1	1	35
J	1	0	0	0	0	0	<10
K	0	-	-	-	-	-	-
L	0	-	-	-	-	-	-
M	3	15	10	0	3	0	10
N	1	0	0	0	0	0	0
O	3	0	1	0	0	0	1
P	1	0	0	0	0	0	<10

stream environments.

The assistance of Dr. L.R. Eckroat during portions of this survey is appreciated.

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OBSERVATION OF OPHIOPHAGY IN THE WESTERN HOOKNOSE SNAKE, *Gyalopion canum*

The few primary literature accounts that discuss the food habits of *Gyalopion canum* indicate that the diet consists exclusively of arthropods, specifically spiders, scorpions, and centipedes (Bogert and Oliver, 1945; Webb, 1960; and Hardy, 1975). These dietary determinations were based primarily upon stomach analyses of rather small samples of preserved material. In the one reference concerning captive feeding observations, Kauffeld (1948) reported that a specimen from Texas accepted only spiders and centipedes. That individual refused all vertebrate food items that were offered, including small frogs, lizards, snakes (all unidentified as to species), and mice. My note constitutes the first report of a captive *G. canum* accepting ophidian prey.

An adult male *G. canum* (22.2 cm s-v) captured under a rock near Lantry, Val Verde County, Texas, on 19 May 1979 was maintained in a plastic shoebox cage along with a *Phyllorhynchus decurtatus* (29.2 cm s-v). During its confinement, the *Gyalopion* refused numerous living and freshly killed spiders that were provided as food. It also apparently ignored the *Phyllorhynchus*, which in view of the subsequent events may have been due to the considerable discrepancy in size between the two snakes.

On 4 June 1979, a dead *Diadophis punctatus* (18.3 cm total) from Payne County, Oklahoma, was placed in the cage with both snakes. Several hours after this introduction the *Gyalopion* swallowed the somewhat dessicated *Diadophis* tailfirst This particular feeding technique is unusual in that several of the typically ophiophagous snake species employ headfirst ingestion, guided by scale orientation cues, to swallow prey (Greene, 1976). The *Diadophis* was too large to be completely en ulfed initially, and its head was visible through the partially opened mouth of the *Gyalopion* for over 14 hr after it was swallowed.

On 7 June, the *Gyalopion* was found dead, and was subse-

qently preserved and catalogued into the collection of the Lousianna State University Museum of Zoology (LSUMZ 37069). A postmortem examination revealed that the posterior third of the body of the *Diadophis* had been digested. Presumably, the cause of death was related to engulfing too large a meal; however, specific toxicity to *Diadophis* could also have been involved (Kauffeld, 1967).

While it must be conceded that behavioral observations on one captive individual are of limited value, this observation suggests that *Gyalopion canum* may possess a greater dietary flexibility than is indicated by our limited knowledge of the natural history of this species. Confirmation of the importance of ophiophagy in wild populations must await further field observations and stomach analyses. Additional research with captive specimens and with live *Diadophis* as well as other small sympatric snake species such as *Sonora* and *Tantilla* might also prove enlightening.

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ALBINISM IN *CORYTOPHANES HERNANDEZI*

(LACERTILIA: IGUANIDAE)

Knowledge of the occurrence of albinism in North American reptiles and amphibians has been summarized by Hensley (1959). Most species cited in that report are restricted to the neartic region, and snakes predominate. Subsequent reports in *Diadophis punctatus arnyi* (Earle, 1958), *Thamnophis elegans vagrans* (Tanner, 1966; Smith et al., 1975) and *Arizona elegans* (Harris and Simmons, 1968) continue the same trends. Reports for tropical lizards are, however, extremely rare.

In September 1980, I collected an albino specimen of *Corytophanes hernandezi* in a tropical rain forest 10km N La Palma, municipality of San Andrés Tuxtla, Ver., at 180 m (a.s.l.).

This specimen is an immature male, 100 mm snout-vent length. Head white-pink (including the rostral and gular regions), in dorsal view only a small dark zone representing the eye evident through the transparent skin above the orbit. Iris pale blue in life. Dorsal, lateral, and ventral regions of body, as well as tail and limbs, white-pink, without pigmentation. When observed in transmitted light, the belly and the limbs have some transparent areas.

The specimen lived in captivity for ten days with other specimens of normal colour, but no change in its coloration occurred. Its scale characteristics are normal.

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Distributional Records for Maryland Herpetofauna

Distributional records and comments on Maryland amphibians and reptiles are presented below. Specimens are deposited in the following collections: Natural History Society of Maryland (NHSM), Towson State University (TSU), National Museum of Natural History (USNM). BZ refers to the former Baltimore Zoo collection (now NHSM).

Siren "lacertina" (NHSM A 4574; formerly TSU 1132). Harris (1975) tentatively accepted a record for a siren purportedly from Battle Creek Cypress Swamp, Calvert County, and assigned it to the species most likely to occur in Maryland, *S. lacertina*. Subsequent x-rays of the specimen have shown it to be *S. intermedia* (H.S. Harris, Jr., pers. comm.). The acceptance of this specimen as valid would necessitate a northward range extension of roughly 260 km from the northernmost known locality in the eastern United States (Palmer et al. 1974). Owing to the uncertain provenance of the specimen, the inability to collect additional material, and the considerable range extension involved, it seems best to disregard this locality. Technically *Siren* is not known from Maryland; the only record north of the Potomac River is based on USNM 12573, an adult *S. lacertina* from "Potomac Flats," District of Columbia. This specimen was first mentioned anonymously (1882) and later by Hay (1902).

Ambystoma maculatum (TSU 2677). An egg mass was collected by J.F. Cover and the writer from a woodland depression 6.7 km E Easton, Talbot County, on 1 April 1979. The locality adds slight definition to the Eastern Shore distribution as plotted by Harris (1975).

Ambystoma tigrinum tigrinum (NHSM A 4779; formerly BZ 498). This enigmatic specimen, which has been mentioned several times in local publications (e.g., Cooper 1965; Harris 1969, 1975; Committee ... 1973), has only just recently been catalogued into a permanent collection. It was collected on 5 September 1962 by a resident of Pines-on-Severn (S Arnold), Anne Arundel County. Accompanying data state that it was "Found crossing walk of collector's home." This is the only known individual from the county and only the second locality for Maryland's coastal plain west of the Chesapeake Bay. Despite attempts to locate suitable breeding sites in the area,

none have been found (Committee.... 1973). This locality is separated by some 70 km from the only other known Western Shore, Maryland population (near LaPlata, Charles County, since extirpated).

Desmognathus ochrophaeus (TSU 3890-3894). Cooper (1960) first restricted this salamander's distribution in Maryland to the Alleghany Plateau (Garrett and extreme western Allegany Counties), and Franz (1972) later reaffirmed this. Recently, however, G. Walker collected five specimens from Piclic Run at Fifteen Mile Creek Road, Green Ridge State Forest, Allegany County, on 13 May 1979. The locality (elevation 220 m) is in the heart of Maryland's Valley and Ridge Province, and while within the species' range as shown by the maps of Tilley (1973) and Conant (1975), is nearly 30 km east of Franz's (1972) nearest Allegany County site. Piclic Run is notable also as the only known locality in the interior of the Valley and Ridge of Maryland where *Gyrinophilus porphyriticus* has been taken (Platania 1976).

Eurycea longicausa guttolineata. This form (considered a species by many workers--e.g., Martof et al. 1980) was stated in a book review by Suttkus and Gordon (1956) to "range into Maryland," but this article has been overlooked by compilers of distributional data on Maryland herpetofauna (viz., Cooper 1960, 1965; Harris 1969, 1975). The Suttkus-Gordon statement was based on a conversation Gordon had with J. A. Fowler, who left Gordon with the impression that he had collected *guttolineata* in Frederick County sometime prior to 1950 (R.E. Gordon, pers. comm.). J.A. Fowler has informed the writer (pers. comm.) that he has never collected this salamander in Maryland and that the Suttkus-Gordon comment undoubtedly resulted from a misunderstanding.

More recently, Ireland (1979) has plotted a locality and mapped this form as ranging throughout Maryland's piedmont. Ireland (pers. comm.) has collected two specimens "between Church Hill and Mountville" (ca. 11 km SW Frederick), Frederick County, presumably from a tributary to Tuscarora Creek. The site lies in the piedmont at an elevation of 120 m and in very close proximity (1.5 km) to the Blue Ridge escarpment. Details regarding this first valid record of *guttolineata* in Maryland are not available; the material is in Ireland's personal collection and will eventually be deposited in the American Museum of Natural History.

While the three-lined salamander may now be added to Maryland's faunal list, there is little likelihood that, as mapped by Ireland (1979), *guttolineata* is widespread in this state. Ireland's map as it pertains to *E. l. longicauda* in Maryland is in error; Conant (1975) and Harris (1975) correctly show its range limits.

Of additional interest is a specimen of *Eurycea* in the Harris-Simmons collection (NHSM/HSH-RSS AS 466) from Great Falls, Montgomery County, about 42 km southeast of Ireland's site. While closer to *E. l. longicauda* the dorsal markings of typical *longicauda* have coalesced to the point of imparting a *guttolineata*-like appearance, and there is also a small amount of ventral flecking. This is the only potential intergrade (or hybrid) from Maryland which the writer is aware of.

Hemidactylium scutatum (TSU 3645). An attendant female and her clutch of 43 eggs were collected by the writer 3.8 km SE Millers on 25 April 1980, providing the first locality for the species in Carroll County. The specimen (37 mm SVL; 76 mm TL) was taken from the edge of a woodland pool and was principally using the bryophyte *Bryhnia novae-angliae* as nesting material Small quantities of *Leptodictym riparium* and *Thuidium delicatulum* were also present in the sample (J.A. Snider, pers. comm.). Several other brooders were noted in the area, which lies in the piedmont at an elevation of 240 m.

Bufo woodhousei fowleri (TSU 1787). A series of four Fowler's toads was collected along Custer Gulch Trail, Mertens Avenue, 1.2 km S JCT Mertens Avenue and Twigg Road, Green Ridge State Forest, Allegany County, on 12 June 1977 by J.D. Forester, at an elevation of 300 m. These currently represent the westernmost positively identified specimens from the state. The report of this species from Jennings, Garrett County (Fowler 1925) is not substantiated by material in the Academy of Natural Sciences of Philadelphia, the institution Fowler was associated with (R. Cummins and C.L. Smart, Jr., pers. comm.).

Gastrophryne carolinensis (TSU 3896). An eighth record for Maryland and a second locality for St. Mary's County are represented by a specimen from SE Beauvue, Md. Route 244, 0.5 km W JCT Md. Route 244 and McKay's Road. It was collected in early September 1979 by M. Tegges.

Rana virgatipes (NHSM A 4781). A carpenter frog, taken on 1 June 1979 by W.S. Sipple and W. Klockner, was collected ca. 1.5 miles (0.9 km) NE Baltimore Corner and represents the first specimen from Caroline County. Additional data accompanying the specimen state that it was collected from an acidic, glade-type, pothole wetland dominated by *Carex* cf. *rostrata* and sphagnum, with one large area of *Woodwardia virginica*. Sipple (1976) provided the first locality for Caroline County (ca. 1.0 mile [1.6km]N Hollingsworth Crossroads) and noted a second locality for the county in an environmental impact statement by other workers (by interpretation, vicinity of Mount Zion), but apparently no material was collected from these sites.

Sternotherus odoratus (TSU 1694-1695). Two specimens from Beaver Branch, 1.0 km W Rocky Ridge, Frederick County, suggest that this species is extensively distributed in the Monocacy River drainage. The nearest previously plotted site (Potomac River or immediate vicinity thereof--Harris 1975) is some 50 km downstream from the present locality. The specimens were collected on 5 May 1977 by J.F. Cover and G. Grall, at an elevation of 120 m.

Carphophis amoenus amoenus (TSU 1842). A juvenile, 107 mm TL, was collected along Piclic Run at Fifteen Mile Creek Road, Green Ridge State Forest, Allegany County, on 3 October 1975 by D.C. Forester et al., at an elevation of 220 m. The specimen is the second record for the county. The other locality for Allegany County and westernmost station for the state are based on USNM 141385 from Christie Road, 3.0 miles (4.8 km) "from" Cumberland.

Cemophora coccinea copei (NHSM R 2361). A juvenile, 153 mm TL, received from Chesapeake Biological Laboratory and collected by a resident of Olivet, Calvert County, represents only the tenth valid record for this species in Maryland. It was found in a basement window well on 14 September 1977.

Elaphe guttata guttata (NHSM R 2474; formerly BZ 85). Like NHSM A 4779 above, this Baltimore County specimen, one of the more perplexing records for the state, has just recently found its way into a permanent collection. This snake, collected on 8 June 1957, has been stated in an appendix by Harris to Cooper (1965) to have been collected "about 4 mi. S. of Loch Raven Dam" and by Harris (1969,1975) to be from "4

mi. s. Loch Raven," but the Baltimore Zoo catalogue card accompanying the specimen states that it came from 4.0 miles (6.4 km) above (north) Loch Raven Reservoir Dam. A conversation with the collector of the snake, W.J. Sentz, indicated that the Baltimore Zoo catalogue card information is correct, and provided further clarification of the site, which may now be stated to be a (then) field off the south side of Blenheim Road, 0.5 km E JCT Blenheim Road and Md. Route 146. This clarification notwithstanding, the writer agrees with Harris (1969, 1975) that this corn snake most probably represents a released or escaped pet.

It is perhaps also worth clearing up one other particular regarding the specimen. It was noted by Harris in his appendix to Cooper (1965) that this snake "laid fertile eggs," while the Baltimore Zoo data card states it "deposited 13 eggs (appear to be infertile)." F. Groves (pers. comm.) has informed the writer that, while in the possession of Sentz, the specimen deposited 13 eggs on 13 June 1957. Upon being brought to the Baltimore Zoo the next day (14 June), Groves noted that the eggs appeared fertile, if somewhat dehydrated. Sentz retained the eggs, which never hatched, and apparently never opened them to check for fertility.

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BOOK REVIEW:

AMPHIBIANS AND REPTILES OF THE CAROLINAS AND VIRGINIA. By Bernard S. Martof, William M. Palmer, Joseph R. Bailey, and Julian R. Harrison III. Photographs by Jack Dermid. Chapel Hill, University of North Carolina Press. 264 pp. ill. (color). Hardbound. $14.95.

This beautifully illustrated book is the first attempt at presenting a general non technical field guide to the reptiles and amphibians of this long neglected and herpetologically rich section of the country. It is fittingly dedicated to the late Bernard Martof. The book begins with three well written and interesting chapters covering a general introduction, a history of the herpetology of the Carolinas and Virginia, and a description of the physiography, vegetation, and climate of the region. The introduction includes a well written discussion of the conservation of amphibians and reptiles, a section particularly suited to an amateur herpetologist or naturalist in the area. There is a list of endangered, threatened, and concern amphibians and reptiles which was put together based on recent endangered species symposia within each state, although, unfortunately, there is no mention as to which of the species receive federal or state protection, and there is no mention in the reference section to any of the three symposia volumes (admittedly, Virginia's symposium proceedings have recently been published and South Carolina's may have come out after submission for printing. However, both should have been referenced as in press). A list of amphibians and reptiles of the Carolinas and Virginia, with order, family, common and scientific names, completes the first section of the book.

The remainder, and bulk, of the book is given to descriptions and discussions of individual species. Classes and orders are mentioned briefly at the beginning of each group. Each species is then presented, including a color photograph, range map within the region, general description, a few life history notes, and miscellaneous information. At the end of the book is a glossary of terms and a list of useful references.

One can only call the photographs outstanding; they are the best I have ever seen in any scientific or non technical publication. The reproduction is top quality and the

high quality paper used in printing enhances their attractiveness. The range maps, however, leave a little to be desired. For instance, *Ambystoma jeffersonianum* is given too broad a range in the map although the range in the text is correct; the range of *Plethodon punctatus* is incorrect since it straddles the border of West Virginia and Virginia; the Scott County, Virginia, record for *Plethodon dorsalis* is overlooked; while the text correctly states that *Nerodia erythrogaster* occurs on the Delmarva Peninsula, the map is not shaded; the range of *Tantilla coronata* is not nearly as continuous within Virginia as indicated. Perhaps these are minor criticisms in a non technical book, but they should be updated in future editions.

My major criticisms involve the information presented on the sea turtles. With regard to the loggerhead, it is incorrect to state that mating occurs just beyond the surf. Various sea turtle researchers have reported mating far off the coast of the eastern United States although where regular mating takes place is virtually unknown. To say an individual lays on a 2 or 3 year cycle is also an oversimplification as was repeatedly brought out at the recent World Conference on Sea Turtle Conservation. While some females do nest on such a cycle, the vast majority would appear, as unlikely as it seems, to nest only once, based on tag returns. The loggerhead also still regularly nests in Virginia at Chincoteague and on the other barrier islands; in fact, it nests occasionally as far north as New Jersey. A map showing major loggerhead rookeries, such as at Cape Romain, the southern barrier islands in South Carolina, and Bear Island in North Carolina, would have been appropriate. The tendency of some green turtles to bask in Hawaii, which is mentioned in the text, is insignificant to the Virginia-Carolina area while the significant use of the Chesapeake Bay by loggerheads and perhaps other species is overlooked. To say that the green turtle occurs in large numbers in the Caribbean is also relative. Many rookeries no longer exist, and numbers no where near approximate the vast numbers reported by early explorers. The Caribbean green turtle is in serious trouble.

Perhaps the most bothersome account to me concerns the discussion of the Kemp's ridley (*Lepidochelys kempi*). While the authors correctly point out the critical state of the survival of this species (p.170), one wonders why this is so considering 40,000 females come ashore to nest during an arribada, with as many as 10,000 females on the beach at one time (p.169).

What is not stated is that these numbers were based on 1947 data. In 1978, only 500-600 females nested at Rancho Nuevo with an estimated world population of about 1000 females and still declining. It is also debated as to the importance of the eastern coast to the ecological requirements of this species: are those Kemp's ridleys found off the east coast waifs or are they making periodic migrations? Some parts of the Virginia-Carolina area, such as the Chesapeake Bay, may indeed be important to Kemp's ridley. And to be picky, both olive ridleys *(Lepidochelys olivacea)* and hawksbills *(Eretmochelys imbricata)* regularly nest during daylight hours in parts of their ranges.

The alligator account is particulary trivial and anecdotal. There is a wealth of interesting behavior and ecology of this important species which could have been discussed, yet wasn't. And for the record, some females challenge intruders to their nests, but many do not.

Finally, I found the glossary to be useful, but would have liked to see diagrams illustrating such things as where loreal and labial scales are located, such as in Barbour's "Amphibians and Reptiles of Kentucky" (Univ. Press of Kentucky, Lexington, 1971), as well as a dichotomous key. Both would be exceptionally valuable to amateur herpetologists and naturalists.

In spite of my biases with regard to the sea turtle accounts, I strongly recommend this book to both the scientific and non scientific public. It's strengths outweigh its weaknesses; the color phótography alone makes the book worth the price.

We can only hope the authors have a good technical book in mind on the herpetology of this important region.

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Tarichatoxin: A unique Toxin Isolated from Western American Newts

Many salamanders are known to have substances in their bodies which are toxic to other animals. Those poisons are generally secreted by specialized glands in the skin or the mouth and are not extremely toxic when taken in small or moderate amounts. In the family Salamandridae, however, an extremely potent toxin called Tarichatoxin, named after the genus *Taricha* in which it was first isoloated, has been found to be completely different from the toxins of all other salamanders. Tarichatoxin occurs not only in the skin of Western American newts (genus *Taricha*) but throughout their entire bodies. This toxin has also been determined to be deadly, even in very small amounts, to animals coming in contact with them. Finally, Tarichatoxin has been discovered to be identical to a toxin called Tetrodotoxin isolated from the Japanese puffer fish.

Tarichatoxin was first isolated by Twitty (reviewed in 1937), when he was studying various aspects of the California newt, *Taricha torosa*. He noticed that when eye vesicles from *T. torosa* were transplanted into an embryo of *Ambystoma tigrinum*, the latter became paralyzed for several days. After further experiments, Twitty was able to show that the toxin was present in all tissues of *T. torosa* embryos as well as in the blood of some adult females. In later experiments, Wakely et al. (1966) were able to show that Tarichatoxin was found only in the family Salamandridae and particularly in *Taricha torosa*, *Taricha rivularis*, and *Taricha granulosa*. Smaller amounts of the toxin were also found in *Notophthalmus viridescens* and *Cynops pyrrhogaster*, as well as some others. They also found that in adult *T. torosa* the toxin is concentrated in the skin, ovaries, ova, muscles, and blood. It may also be found in trace amounts in the liver, viscera and testes. These salamanders are the only ones known in which a toxin may be found concentrated in such large amounts in pats of the body other than the skin.

Tarichatoxin is also one of the deadliest nonprotein toxins known. In studies done by Mosher et al. (1964) it was shown that the minium lethal dose of toxin injected in the intraperitoneal cavity of mice is approximately 8 mg of toxin/kg of body weight. The only nonprotein toxin with a lower minimum lethal dose is Koki venom from the frog *Phyllobates bicolor*, at 2.7 mg/kg administered intravenously. It comparison with other nonprotein toxins, strychnine has a minimum lethal dose of 500 mg/kg and sodium cyanide 10,000 mg/kg.

Tarichatoxin acts as a neurotoxin by blocking the action potentials of desheathed frog nerves when applied in concentrations as low as 1 to 10 mg/l (Mosher et al., 1964). It has also been shown that in lobster *(Homarus americanus)* giant axons Tarichatoxin blocks the conductance of socium which is necessary for the action potential to travel across synapses (Takata et al., 1966). Because of this blockage of action potentials, Tarichatoxin, when injected into mammals, causes paralysis of muscles, a fall in blood pressure, respiratory arest, and death, even when only small amounts are injected (Mosher et al., 1964). However, when desheathed sciatic nerves from *T. granulosa* are treated with the toxin at a concentration of 30,000 mg/l for 20-30 minutes, only a partial blockage of the actin potential was recorded (Mosher et al. 1964). It is not known how *Taricha* is able to withstand such high concentrations of the toxin.

It was long believed that this toxin was only found in one family of amphibians, namely the Salamandridae. Experiments by Mosher and others, however, showed that a toxin called Tetrodotoxin, which is found only in one suborder of fish (Tetraodontidae) and mainly in the puffer fish, *Tetraodon lineatus* is chemically and pharmacologically equivalent to Tarichatoxin. Puffer fish poisoning has been known for some time to ocur in men who eat the fish. The symptoms of this type of poisoning include paralysis, fall of blood pressure, respiratory failure, and death. These are the same symptoms which occur in poisoning from Tarichatoxin.

A direct link between the two toxins could not be established, however, until 1964 when Mosher was able to obtain enough Tarichatoxin in a crystalline form to compare with crystalline Tetrodotoxin. He was then able to perform chromatography tests using spots of Tarichatoxin, Tetrodotoxin, and a mixture of the two toxins. All three spots behaved identically and rose to the same point on the chromatography paper. Other chemical identifications were performed on the two toxins and on their degradation products. Both toxins have the same

molecular weight, the same chemical formula, and give the same degradation products. Both toxins also react with the same chemicals in the same way. Neither structure had been positively worked out as of 1964, but both toxins had been narrowed down to just a few possible structures. Based on these works, it may be shown that Tarichatoxin and Tetrodotoxin have either identical structures or differ only in the arrangements of certain chemical groups in the molecules.

In summary, Tarichatoxin is a toxin unique to amphibians, found only in the family Salamandridae. It is the only toxin found concentrated throughout the entire body of any amphibian, and it is one of the most lethal nonprotein toxins known. It is either the same toxin or is very similar to Tetrodotoxin found only in one suborder of fish. These facts suggest that other families of amphibians and fishes might have the same or similar toxins in their bodies. However, none have been found to date and it is still a mystery why these toxins are limited in distribution as they are.

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The Absence of Sea Snakes in the Atlantic Ocean

The Atlantic Ocean, a seemingly ideal habitat for sea snakes, is completely devoid of these otherwise widespread marine reptiles. The barriers that have blocked their dispersal into the Atlantic are not so obvious and pose questions that end only with additional questions.

Until only recently there has been very little interest and study of these unique reptiles, perhaps because sea snakes are tropical and biologists are not, or because of the general fear and myths associated with the sea snake and its highly potent venom, or as a result of the general inaccessibility of the ocean for herpetologists. Whatever the reason, knowledge is sparse. Sea snake paths of dispersal, radiation, and colonization are of treat interest, especially in light of their possible future migration through the Panama Canal if it is ever built to sea level. The barriers that result in their confinement within certain oceanic areas are here discussed.

Certainly physical land mass barriers that were present during radiation of sea snakes are of utmost importance, and so are temperature, salinity, currents and predation.

Snakes are believed to have diverged from the dibamid lizards or close amcestprs tjerepf diromg the Cretaceous period, about 120 million years ago. At this time Laurasia and Gondwana had each formed two separate land masses and the earth began to take the shape it has today.

The Columbridae, Viperidae, and Elapidae became established during the Miocene period. The elapids (coral snakes, cobras, mambas, kraits) are the direct ancestors of the hydrophids (sea snakes). During the Pliocene, which immediately followed the Miocene and began about four million years ago, the Panama land bridge was permanently closed. Access to the Atlantic thereafter was possible only around the tip of South America or Africa. Therefore the hydrophiids had to have migrated eastward from the western Pacific after this time, else they would presumably have entered the Atlantic Ocean through the Panamanian portal.

The Hydrophiidae family is divided into two subfamilies:

Laticaudinae, which has an Afroasian lineage with one genus, and the Hydrophiinae, of Australian lineage and eleven genera as recognized by Dowling and Duellman (1978). There are about 55 kinds in all.

Hydrophiids are widely distributed between South Africa and Japan, including Madagascar, the Gulf of Aden, the mouth of the Persian Gulf, the Arabian Sea, Bay of Bengal, South China Sea, Yellow Sea, China Sea, Philippines, Indonesia, New Guinea, Australia, New Zealand, Coral Sea, Tasmania Sea, New Hebrides, Fiji Islands, and Gilbert Islands. From the western Pacific and Indian Ocean they are found eastward between southern California and southern Ecuador. The Red Sea, Mediterranean and Atlantic have none.

The tropical Indo-Pacific provides an optimal habatat. Sea temperatures are around 25 degrees C and never fall below 20 degrees C. Salinity is fairly uniform, about 3.4%. The richest benthic fauna of the world is present here. Broad continental shelves, great reefs, 10,000 kilometers of coastline and a magnificent diversity of food exist. This provides the basis for the extensive endemism, diversification and specialization evident in sea snakes.

Excepting *Pelamis platurus* from consideration, all are benthic feeders. Diving depth is usually 15-20 meters. They have an amazingly high tolerance to anoxia. Pickwell (1972) indicated that *Pelamis* tolerated 5 hours of submergence and *Laticauda* surfaced every 10-20 minutes under laboratory conditions. Increasing temperature lowers their submergence time. Most are thus confined to regions of depths less than 100 fathoms. *Laticauda*, however, seems to have an amazing ability to cross areas of great depth.

A few species are land-locked in inland lakes and several flourish along river mouths and estuaries.

Small migrations are common, involving seasonal weather patterns, shifts in currents, prey and reproductive cycles.

During the monsoon season, snakes are abundant along the coasts and estuaries of southeast Asia. They are probably seeking cooler waters or lower salinity levels or are following shifts of prey abundance. During the dry season they are more commonly found in the open ocean. Many species go in-

shore to lay their eggs in the shallows or sands.

Pelamis platurus , the yellow-bellied sea snake, is the only snake that has successfully and abundantly colonized the eastern Pacific, although there are a few reports of *Laticauda* off the coast of Mexico and Central America. *Pelamis* has also reached Cape Town in South Africa, as well as New Zealand and Tasmainia. Being a surface feeder, it drifts with the surface currents as if completely planktonic.

Often the Yellow-bellied sea snakes accumulate by the hundreds and thousands in large surface slicks or Langmuir circles. These are large rotating areas of converging and diverging currents where debris, fish and upwellings accumulate, serving as an excellent food source for the pelagic *Pelamis*. This snake must wait for its prey and feeds in a frenzy when food is near, biting at whatever is detected.

Pelamis has the most efficient and effective salt gland of all sea snakes. It has a large sublingual gland and secretes salt very rapidly, enabling it to live indefinitely in full strength sea water.

The open ocean tends to be higher in salt content than coastal regions, where rivers actively flush fresh water. Also evaporation tends to be quite high without strong precipitation except at equatorial regions where there is heavy rainfall and therefore lower salinity. However surface waters tend to be warm and saline.

Pelamis seems to be very sensitive to high temperatures, having an upper limit of 33 degrees C. In the tropical Pacific temperatures often get as high as 31 degrees C and possibly higher. It is rarely found in coastal waters of the western Pacific and Indian Ocean, possibly avoiding high temperatures and low salinity or perhaps some kind of predation or heavy competition for food resources since it lacks the ability to actively pursue food, as do otehr sea snakes.

There seems to be no real predation upon *Pelamis* except by occasional sea birds, eels and sharks. Its aposematic coloration of brightly colored yellow belly and spotted tail certainly acts as a warning, for its venom is highly deadly. The snake seems to be perfectly adapted for its pelagic life-

style. Since it bears its young at sea it never wilfully crawls onto land, although currents often beach them on the eastern Pacific coast, leaving them helpless.

What if the Panama Canal were made sea level? *Pelamis platurus* could most certainly make the passage. Tidal currents would carry the snake in.. Survival in the fresh water would be no real threat. It has been kept in tap water for up to six months without ill effects (Dunson and Ehlert, 1971).

The major inhibiting factor would be initial predation. Tests performed by Rubinoff and Kropach (1972) showed that no Pacific predataory fish would attack *Pelamis* whereas Atlantic fish readily attacked. Nine percent of attacks by Atlantic fish led to their death. Selection pressures against predators of *Pelamis* would no doubt eventually lead to avoidance. BAsed on temperature, an area from North Carolina to Brazil could theoretically become colonized.

As far as elimination by humans is concerned, virtually no threat exists. Sea snakes do have highly potent venoms but rarely attack unless strongly provoked, and even then do not inject a full dose of veno. Kropach (1972) was bitten six times without any envenomation. *Pelamis* is relatively abundant on the Mexican coastline where human activity is fairly heavy. Most people don't even realize this snake is venomous and there are no reported deaths. Fishermen insoutheast Asia seem to fear only a few kinds and Malaysian children play with them frequently. This is not to say that sea snakes are harmless, for they most certainly are not, but there is no reason for a great amount of fear to be generated by them.

The main current that blocks off entry into the Atlantic by way of southern South America or Africa is the Antartic circumpolar current. It has the largest transport of any current (330 X 10^6 m^3/sec). It is extremely cold and flows eastward, with branches flowing northward on both sides of South America and on the west side of Africa.

The currents on western sides of oceans are swifter than on the eastern sides because of prevailing west wind drift. There is a general counter clockwise circulation pattern in the Southern Hemisphere which prevents entry westward into the Atlantic.

The Humboldt current travels up the western coast of South America, flowing westward just south of Ecuador. It is fed by the cold Antartic waters and acts as an effective block to any travel southward.

The Benguela current flows northward along the western African coast. The Antarctic circumpolar current feeds and merges with this current, effectively acting as a barrier to any northward movement from the western Pacific by a warm water surface dweller. *Pelamis* is carried to Cape Town bythe Aguthas current, a relatively warm flow that follows southward off the eastern African coast around the Cape of Good Hope until it hits the Benguela current. *Pelamis* would die quickly once entering this cold body of water.

The Red Sea was never colonized because of high temperatures and high salinity (3.8% - 4.1% whereas the open ocean is 3.5%). The Mediterranean gets far too cold to support sea snakes even if there were access to it. Of course any northerly interchanges between the Pacific and Atlantic are totally precluded by the cold waters of the Arctic Ocean.

In conclusion, it appears that the absence of sea snakes in the Atlantic Ocean is a result of (1) origin of sea snakes in the western Pacific and Indian Ocean; (2) their nearly universal (excepting only *Pelamis* and perhaps *Laticauda)* limitation to shallow, warm waters near the continental shelf, thus limiting dispersal; (3) the absence of any warm water portal between Atlantic and Pacific after a very few species of sea snakes did manage to disperse to the eastern Pacific; and (4) the flow of lethally cold currents of Antarctic origin in the south Atlantic Ocean at both the African and South American capes, completely preventling access to the ATlantic Ocean in these areas.

We also conclude that any sea-level portal constructed in Central America would soon result in colonization of tropical parts of the Atlantic Ocean by *Pelamis*, despite moderately heavy initial predation by fishes that eventually would be expected to evolve avoidance behaviors as have exposed fishes the Pacific.

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Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

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All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $6.00.

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FIELD KEY TO THE WHIPTAIL LIZARDS (GENUS: *CNEMIDOPHORUS*)
PART II: THE WHIPTAILS OF MEXICO

Thomas Vance

MdHS........A FOUNDER MEMBER OF THE
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A FIELD KEY TO THE WHIPTAIL LIZARDS (GENUS: *CNEMIDOPHORUS*) PART II: THE WHIPTAILS OF MEXICO

Thomas Vance

ABSTRACT

The key presented is for identification of cnemidophorine lizards of Mexico. A short bibliography which summarizes current identification data of the whiptails and racerunners is included as well as series of maps with estimates of ranges.

The diversity of whiptail and racerunner lizards presents many problems for the taxonomist. The major problems are involved with overlap of morphological characters and with ontogenetic changes, especially in adult males, which are known to take place in many species. Other factors which could be considered are found in bibliographic entries.

This key is the second of a series, the first having been prepared for whiptails of the United States (Vance, 1978). The purpose of constructing keys for geographical or political regions is to aid with the identification by eliminating many taxa which would otherwise key out improperly. Having been devised for use in the field, the couplets include only concise characters which are most consistent for the species in question.

This manuscript has been based on the species-groups concept; however, several forms are known to possess characteristics of other groups. For this reason, some taxa appear with more than one of the couplets. One such example was reported by Smith and Brandon (1968) for certain members of the *deppei* species group. Other members are also difficult to identify because of a wide overlap of morphological characters. The members of the *hyperythrus* group

are identified by color and pattern while identification of members of the *tesselatus, sexlineatus and deppei* groups are based on color, patterns, and scalation differences.

Many variations exist in this genus. Populations of subspecies may show enough variation in isolated communities to be considered recognizable taxa. Hendricks (1975) and Walker (1967) named several new subspecies in their dissertations which are available, commercially, in the form of microfische. The populations described appear to be close to the subspecific level of organization. For this reason, the two new names proposed by Hendricks, and the two names proposed by Walker may very well represent these populations. Investigators should be advised, however, that these names presently have no formal taxonomic validity due to the fact thay they have not been officially published along with descriptions, and if used in print, become *nomina nuda* (Webb, 1970), but Smith and Smith (1976) and Williams (1976) recognize such names as being legitimate, consequently a ruling concerning this problem is much to be desired. Of the above, *C. t. reticuloriens* Hendricks, was included in a previous key (Vance, 1978).

One recently discussed problem involves the recognition of *C. t. stejnegeri* which has been synonymized with *C. t. multiscutatus*. The two names are included in the key because they may represent two separable forms. This problem is discussed by Burger (1950), Smith and Taylor (1950), Stebbins (1954, 1966), Cochran and Goin (1970) and Behler and King (1979). Zweifel (1958, 1965) is of the opinion that *stejnegeri* should be the name applied to the mainland form while *multiscutatus* would refer to the Cedros Island populations as do Smith and Taylor (1966). Another problem regards the ranges of *C. t. aethiops* and *C. t. gracilis* which have been questioned by Burger (1950), Smith and Taylor (1950, 1966), Duellman (1955), Zweifel (1958), Williams (1960), Stebbins (1954, 1966), Walker, et al. (1966) and Cochran and Goin (1970). Vance (1978) had extended the range of *aethiops* into southern Arizona, but most authorities restrict it to Mexico. Its inclusion in the United States key and maps was due to its relatively unknown distributional status and the possibility of it occurring within the boundaries of Arizona. Smith and Smith (1976) provide full specific rank to *C. t. canus, C. t. martyris* and *C. t. maximus*, and had recognized *C. t. dickersonae* as did Smith and Taylor (1966) and Soul and Sloan (1966). More research is needed to substantiate these changes of nomenclatoral status. Hendricks (1975) presented a thorough account of the *tigris* subspecies which occur east

of the Continental Divide, but the taxa west of this line are in need of a revisionary study.

The classical keys of Burt (1931, 1935) were complicated to use and included only species which were recognized at the time. Other significant keys which have recently appeared and are concerned with the United States-Mexican species were published by Smith (1946), Smith and Taylor (1950), Stebbins (1954), and Savage (1959). Zweifel (1959) prepared a key for *burti, communis,* and *sacki*; Duellman and Wellman (1960) for the *deppei* species group; Lowe, et al. (1966) for the striped and unspotted representatives of the southwest United States and northern Mexico, and Wright (1968) prepared a thorough key for *inornatus, velox,* and *uniparens.* Identification matrices of major importance were prepared by Duellman (1962) for the taxa of Michoacan; Duellman and Zweifel (1962) for the *sexlineatus* group; Walker and Taylor (1968) for the *caeruleus*-like species and subspecies; Lowe and Wright (1964) for *exsanguis, flagellicaudus,* and *sonorae;* Maslin and Walker (1965) for *alpinus, scalaris, gularis* and *mexicanus;* and Walker (1980) for *alpinus, costatus, mexicanus,* and *parvisocius.* Due to the abundance of recent literature, a revisionary key is necessary in order to accomodate the newly named species and subspecies.

A total of 32 species and 56 subspecies are recognized by the author which are known to range into, or be endemic to Mexico. The following representatives are included in the key: *C. alpinus* Maslin and Walker, *C. angusticeps angusticeps* Cope, *C. bacatus* Van Denburgh and Slevin, *C. burti burti* Taylor, *C. b. stictogrammus* Burger, *C. calidipes* Duellman, *C. catalinensis* Van Denburgh and Slevin, *C. ceralbensis* (Van Denburgh and Slevin), *C. celeripes* Dickerson, *C. communis communis* Cope, *C. c. mariarum* Gunther, *C. costatus costatus* Cope, *C. c. barrancorum* Zweifel, *C. c. griseocephalus* Zweifel, *C. c. huico* Zweifel, *C. c. mazatlanensis* Zweifel, *C. c. nigrigularis* Zweifel, *C. c. occidentalis* Gadow, *C. c. zweifeli* Duellman, *C. cozumela cozumela* Gadow, *C. c. maslini* Fritts, *C. deppei deppei* Wiegmann, *C. d. infernalis* Duellman, *C. d. schizophorus* Smith and Brandon, *C. exsanguis* Lowe, *C. gularis gularis* Baird and Girard, *C.g. colossus* Dixon, Lieb and Ketchersid, *C.g.* sub. sp. (Walker), *C. g.* sub. sp. (Walker), *C. guttatus guttatus* Wiegmann, *C.g. flavilineatus* Duellman and Wellman, *C. g. immutabilis* Cope, *C. hyperythrus hyperythrus* Cope, *C. h. beldingi* (Stejneger) *C. h. caeruleus* (Dickerson), *C. h. danheimae* Burt, *C. h. espiritensis* (Van Denburgh and Slevin), *C. h. franciscensis* (Van Denburgh and Slevin), *C. h. pictus* (Van Denburgh and Slevin),*C. h. schmidti* (Van Denburgh and Slevin),*C. inornatus*

inornatus Baird, *C. i. heptagrammus* Axtell, *C. i. paululus* Williams, *C. labialis* Stejneger, *C. lineattissimus lineattissimus* Cope, *C. l. duodecemlineatus* Lewis, *C. l. exoristus* Duellman and Wellman, *C. l. lividus* Duellman and Wellman, *C. mexicanus* Peters, *C. motaguae* Sackett, *C. neomexicanus* Lowe and Zweifel, *C. opatae* Wright, *C. parvisocius* Zweifel, *C. rodecki* Mc Coy and Maslin, *C. sacki sacki* Weigmann, *C. s. gigas* Smith and Davis, *C. scalaris scalaris* Cope, *C. s. pallidus* Duellman and Zweifel, *C. s. semifasciatus* Cope, *C. s. septemvittatus* Duellman and Zweifel, *C. sonorae* Lowe and Wright, *C. tesselatus* (Say), *C. tigris tigris* Baird and Girard, *C. t. aethiops* Cope, *C. t. canus* Van Denburgh and Slevin, *C. t. estebanensis* Dickerson, *C.t. gracilis* Baird and Girard, *C. t. marmoratus* Baird and Girard, *C. t. martyris* Stejneger, *C. t. maximus* Cope, *C.t. multiscutatus* Stejneger, *C. t.* sub. sp. (Hendricks), *C. t. pulcher* Williams, Smith, and Chrapliwy, *C. t. punctatus* Walker and Maslin, *C. t.* sub. sp. (Hendricks), *C. t. rubidus* Cope, *C. t. stejnegeri* Van Denburgh, *C. t. variolosus* Cope, and *C. uniparens* Wright and Lowe.

In order to avoid repetition, investigators should refer to maps with the United States Key (Vance, 1978), which include the following taxa that are known to range into Mexico: *C. burti stictogrammus, C. exsanguis, C. gularis gularis, C. hyperythrus beldingi, C. inornatus heptagrammus, C. neomexicanus, C. scalaris septemvittatus, C. sonorae, C. tesselatus, C. tigris tigris, C. t. aethiops, C. t. gracilis, C. t. marmoratus, C. t. stejnegeri, C. t. reticuloriens,* and *C. uniparens*. The reader is also advised to consult the map of Harris and Simmons (1977) and Soule and Sloan (1966) in order to pin point islands in the Gulf of California.

In conclusion, the following key must be used in conjunction with the maps and bibliographic materials in order to attain proper identifications. It should also be used, when possible, on adult specimens which are alive or freshly killed, and for which specific collection sites are known.

A TENTATIVE KEY TO THE WHIPTAILS OF MEXICO

1. Presence of only one frontoparietal scale (scales partially divided are considered as one scale) 2

   Presence of two frontoparietal scales 10

2. Mesoptychial scales small 3

   Mesoptychial scales abruptly enlarged 7

3. Presence of anterior bifurcation of dorsal stripe, if present 5

Absence of anterior bifurcation of dorsal stripe, if present 4

4. Presence of 4 evenly defined stripes on a black dorsum; hindlimbs are black with bold white spots. . . . . *C. ceralbensis*

Dorsal stripes very pale or lacking posteriorly; hindlimbs are uniform gray. . . . . *C. hyperythrus pictus*

5. Tail unstriped; dorsal stripes are bluish-white to grayish-blue . . . . *C. hyperythrus caeruleus*

Tail distinctly striped; dorsal stripes are white, cream, or brownish-yellow 6

6. Paravertebral stripes are predominantly black; ventrum is dark blue to bluish-gray. . *C. hyperythrus danheimae*

Paravertebral stripes are predominantly brown; ventrum is white to grayish-white. *C. hyperythrus franciscensis*

7. Presence of 6 dorsal stripes . *C. hyperythrus beldingi*

Presence of 5 dorsal stripes 8

8. Usually 2 or 3 longitudinal light lines on vertebral area . . . . *C. hyperythrus hyperythrus*

Usually, median dorsal light line 9

9. Dorsal stripe not of same intensity and not as wide as lateral stripes but fainter and usually narrow . . . . *C. hyperythrus schmidti*

Dorsal stripe of same intensity and as wide as lateral stripes or wider and diffused . . . . *C. hyperythrus espiritensis*

10. Supraoculars normally 3. 11

Supraoculars normally 4 or 5 24

11. Presence of one pair of dorsolateral stripes . . . 12

Presence of 2 or more pairs of dorsolateral stripes 14

12. Vertebral stripe single; other stripes not replaced by spots . . . . *C. guttatus flavilineatus*

Vertebral stripe paired; other stripes show some evidence of being replaced by spots 13

13. Supraorbital semicircles complete; most stripes are fragmented into spots . . . . . .*C. guttatus guttatus*

Supraorbital semicircles not complete; spots are present but do not replace stripes *C. guttatus immutabilis*

14. Presence of accessory scute between the frontoparietal and parietal 15

Absence of accessory scute between the frontoparietal and parietal 17

15. Usually one enlarged preanal scale flanked laterally by granules . . . . *C. rodecki*

Usually 2 enlarged preanal scales 16

16. Brown dorsal fields; stripes wavy or broken or connected by transverse bars . . . .*C. cozumela cozumela*

Greenish-brown dorsal fields; all stripes straight and not interrupted; absence of transverse bars . . . . *C. cozumela maslini*

17. Spots present on lateral stripes 19

Spots not present on lateral stripes 18

18. Usually 8 stripes present; 88-120 dorsal granules around midbody . . . . *C. deppei infernalis*

Usually 10-11 stripes present; 125-142 dorsal granules around midbody . . *C. lineattissimus duodecemlineatus*

19. Absence of distinct vertical bars on flanks 20

Presence of distinct vertical bars on flanks 21

20. Presence of 3 supraoculars; circumorbitals extend anteriorly to frontal . . . . *C. deppei deppei*

Presence of 4 supraoculars; circumorbitals normal . . . . *C. deppei schizophorus*

21. Paravertebral stripes fused to form middorsal stripe; lateral stripes not usually fragmented. . . . . *C. lineattissimus exoristus*

Paravertebral stripes separate from middorsal stripe; lateral stripe sometimes fragmented 22

22. Flanks and lateral fields are dark brown to black 23

Flanks and lateral fields nearly same color as other fields . . . . *C. lineattissimus lineattissimus*

23. Supraorbital semicircles not complete; vertebral stripes bordered by black. . *C. lineattissimus lividus*

Supraorbital semicircles complete; vertebral stripes not bordered by black *C.lineattissimus duodecemlineatus*

24. Enlarged scales immediately preceding gular fold large (more than 3 times diameter of smallest scales of pregular fold); Postantebrachials enlarged or slightly enlarged; a lined pattern in juveniles and usually adults; usually 5-8 light lines or stripes present; fields are dark; barring is usually limited if present 25

Enlarged scales immediately preceding gular fold small (not 3 times diameter of smallest scales of pregular fold); or if larger, a reticulated pattern is usually evident on the dorsum of adults from northern Mexico, a lined pattern on a dark dorsum in southern Mexico; Postantebrachials granular; dorsal pattern consisting of stripes with spots and/or bars and/or reticulations 62

25. Supraorbital semicircles extend anteriorly past frontal scute .26

Supraorbital semicircles normal 28

26. Bars restricted to flanks and are brownish to cream colored 27

Bars extend onto dorsum and are bluish . .*C. calidipes*

27. Stripes persistent in adult males; absence of barred dorsum; 33-49 femoral pores . . . . *C. parvisocius*

Stripes fade on nape of neck in adult males; presence of barred dorsum; 29-37 femoral pores . . *C. alpinus*

28. Stripes vague or broken; spots or bars present . . .34

Stripes distinct; absence of spots or bars 29

29. Scales bordering anterior of gular fold enlarged and angular 30

Scales bordering anterior of gular fold neither enlarged nor angular, or only slightly so 31

30. Ventrum is brilliant blue of males; chin is immaculate white of females . . . .*C. labialis*

Ventrum is white; males not known to exist; chin is bluish . . . . *C. uniparens*

31. Lack of blue pigment on ventral surfaces . . *C. opatae*

Presence of blue pigment on ventral surfaces 32

32. Dorsal pattern consisting of 8 or 9 light lines on a gray to brownish-green dorsum, dorsum unicolored . .33

Dorsal pattern consisting of 7 light lines on a dark gray to blackish dorsum . . *C. inornatus heptagrammus*

33. Presence of 36 or more femoral pores; 68 or less scales around midbody; dorsum never unicolored . . . . *C. inornatus paululus*

Presence of 35 or less femoral pores; 69 or more scales around midbody; dorsum may be unicolored . . . .*C. inornatus inornatus*

34. Postantebrachials slightly enlarged 35

Postantebrachials greatly enlarged 40

35. Presence of a bar pattern or reticulations 36

Absence of a bar pattern or reticulations 39

36. Dorsum greenish-tan with brown or black crossbars restricted to sides or involving most of the dorsum . 37

Dorsum dark brown; crossbars present on only anterior part of dorsum . . . . *C. communis mariarum*

37. Stripes not persistent; reticulations or crossbars present on dorsum 38

Stripes persistent; reticulations only on sides . . . . *C. angusticeps angusticeps*

38. Dark crossbars on a tan dorsum; chin of males tan colored . . . . *C. sacki sacki*

Dark reticulations on a tan dorsum; chin of males pink . . . . *C. sacki gigas*

39. Stripes persistent to some degree; dorsum grayish-green or entirely green with or without yellow spots . . . . *C. communis communis*

Stripes not persistent; dorsum grayish-brown anteriorly and grayish-green posteriorly with yellow spots . . . . *C. motaguae*

40. Anterior nasal in contact with second upper labial .58

Anterior nasal usually separated from second upper labial 41

41. Stripes persistent along body length, never replaced by bars or spots although they may be present . . .42

Stripes not persistent along body length, replaced by bars or spots or completely absent 47

42. Ventral coloration pale or immaculate 44

Ventral coloration light blue or dark blue 43

43. Ground color greenish at least anteriorly; dorsum not completely spotted; ventrum is dark.*C. gularis gularis*

Ground color brownish; dorsum completely spotted, ventrum is light to moderate blue . . *C. gularis colossus*

44. Dorsal granules 68-80 45

Dorsal granules 81-115 46

45. Ventrals white and tinged with blue; reddish spots on hatchings; spots on nape tends to be present; spots on body very distinct . . . . *C. exsanguis*

Ventrals white and immaculate; spots absent on hatchings; spots on nape tend to fade; spots on body vague . . . . *C. sonorae*

46. Stripes not persistent; granules between paravertebral stripes 5-11; Dorsal granules 98-115 . . . . *C. burti stictogrammus*

Stripes persistent; granules between paravertebral stripes 0-7; Dorsal granules 85-101. . .*C. burti burti*

47. Postantebrachials small or moderate; preoculars in contact with supralabials. . . . .*C. mexicanus*

Postantebrachials large; preoculars not in contact with supralabials 48

48. Chest and abdomen predominantly dark 49

Chest and abdomen predominantly light 55

49. Chin color black, but never light . . . . *C. costatus nigrigularis*

Chin color light, never black 50

50. Presence of bars or reticulations on trunk, or at least on sides 51

Absence of bars or reticulations on trunk 54

51. Presence of small light spots on trunk, spots not restricted to rump 52

Presence of small light spots on trunk, spots restricted to rump only. . . . .*C. costatus occidentalis*

52. Middorsal stripe twice as wide as lateral stripes; crossbars present on dorsum 53

Middorsal stripe absent or nearly as wide as lateral stripes; crossbars present only on sides . . . . *C. costatus huico*

53. Dorsal coloration of fields is greenish, brown, or tan . . . .*C. costatus costatus*

Dorsal coloration of fields is dark brown or black . . . .*C. scalaris scalaris*

54. Dorsal granules 71-103; chin pinkish or reddish . . . . *C. gularis sub. sp.*

Dorsal granules 97-119; chin light blue. . . . .*C. costatus griseocephalus*

55. Presence of reticulations or bars. 56

Absence of reticulations or bars 57

56. Granules around midbody 74-96; ventral coloration is white; chin pinkish or white . . . *C. gularis sub. sp.*

Granules around midbody 91-117; ventral coloration is cream; chin pinkish with a blue spot or bar . . . .*C. costatus zweifeli*

57. Ventral coloration of chin and chest is orange; black spots may be present on chin *C. scalaris semifasciatus*

Ventral coloration of chin and chest is white, bluish or black with or without spots 58

58. Chin without black spots or markings 59

Chin with black spots or markings 61

59. Stripes present; some spotting may or may not be present; dorsum without traces of reddish pigment . . .60

Stripes vague or absent; heavy spotting present; dorsum with some traces of reddish pigment. 46

60. Granules around midbody 71-96; chin is bluish white . . . . *C. scalaris pallidus*

Granules around midbody 91-119; chin is white . . . . *C. costatus barrancorum*

61. Granules around midbody 78-97. . . . . *C. scalaris septemvittatus*

Granules around midbody 95-121 . . . . *C. costatus mazatlanensis*

62. Mesoptychials moderately or considerably enlarged, more than 3 times diameter of smallest scales in median part of pregular fold 63

Mesoptychials small 68

63. Dorsal surface without a barred or checkered pattern; stripes persistent or body heavily spotted 64

Dorsal surface with a distinct barred or checkered pattern; stripes vague and appear as narrow lines. . . . . *C. tesselatus*

64. Supraorbital semicircles extend anteriorly to frontal 67

Supraorbital semicircles normal 65

65. Presence of 6-7 stripes; 2 enlarged preanal scales . . . . *C. opatae*

Presence of 8 stripes; 4-9 enlarged preanal scales .66

66. Spots within or in place of lateral stripes . . . .*C. deppei schizophorus*

Spots absent in broad and distinct lateral stripes . . . .*C. deppei infernalis*

67. Dorsum with evidence of 4 light stripes, or stripes completely absent and dorsum unspotted .*C. catalinensis*

Dorsum with evidence 7-10 stripes which are clearly visible and spotting may be present. .*C. deppei deppei*

68. Ventrum white or pale blue . . . . *C. neomexicanus*

Ventrum with evidence of dark pigmentation 69

69. Gular region entirely black 70

Gular region with at least a few light markings, mottling may be present 74

70. Presence of bars and/or spots on hind limbs 71

Presence of reticulations on hind limbs 73

71. Absence of barring on dorsum 72

Presence of barring on dorsum . . *C. tigris gracilis*

72. Femoral pores 40-50; melanistic and reticulated . . . . *C. tigris variolosus*

Femoral pores 30-42; melanistic and spotted *C. bacatus*

73. Stripes absent or not persistent; ventral coloration predominantly black . . . . *C. tigris sub. sp.*

Stripes present and persistent; ventral coloration of anterior 2/3 black . . . . *C. tigris aethiops*

74. Presence of a striped pattern, body may be unicolored; spotting may be present in linear series 78

Absence of a striped pattern; body not unicolored; spotting may occur at random 75

75. Spots on dorsum forming a barred pattern; gular region marbled . . . . *C. tigris pulcher*

Spots, if present, on dorsum not forming a barred pattern; gular region spotted 76

76. Venter chiefly white, or pale yellow, but washed in peach on throat. . . . .*C. tigris marmoratus*

Venter chiefly black or gray 77

77. Gular region bluish gray with small black dots; color of fields light gray or brown. . . . . *C. tigris canus*

Gular region black with small white dots; color of fields black *C. tigris martyris*

78. Presence of barring 80

Absence of barring 79

79. Venter with large amount of black pigmentation . . . . *C. tigris estebanensis*

Venter with small amount of black pigmentation . . . . *C. tigris punctatus*

80. Presence of a reddish or pinkish pigment on ventrum, disregarding gular and chest region 81

Absence of a reddish or pinkish pigment on ventrum, disregarding gular and chest region 82

81. Granules from interparietal to rump 214-236; stripes persistent . . . . *C. celeripes*

Granules from interparietal to rump 181-220; stripes not persistent . . . . *C. tigris rubidus*

82. Presence of 6-8 stripes which are persistent to some degree 85

Presence of 4-5 stripes which may not be persistent 83

83. Granules around midbody 75-109; granules from interparietal to rump 150-227 84

Granules around midbody 112-134; granules from interparietal to rump 220-269 . . . . . . *C. tigris maximus*

84. Presence of a black ventral tail band *C. tigris tigris*

Absence of a black ventral tail band . . . . *C. tigris marmoratus*

85. Presence of a black ventral tail band. . . . . *C. tigris multiscutatus*

Absence of a black ventral tail band 86

86. Presence of 8 persistent stripes; dorsum not reticulated, but may be barred . . . . *C. tigris stejnegeri*

Presence of 4-7 stripes which may not be persistent; dorsum reticulated 87

87. Dorsal spots form a linear pattern, or body unicolored . . . . *C. tigris sub. sp.*

Dorsal spots not forming a linear pattern; body never unicolored . . . . *C. tigris marmoratus*

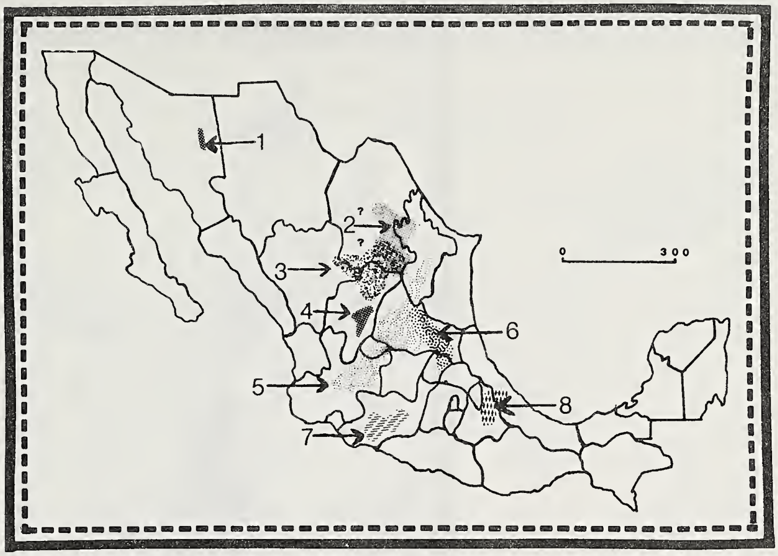

Fig.1. Distribution of *C. opatae* (1), *C. inornatus inornatus* (2), *C. inornatus paululus* (3), *C. gularis* sub. sp. (4), *C. gularis* sub. sp. (5), *C. gularis colossus* (6), *C. calidipes* (7), *C. alpinus* (8).

Fig.2. Distribution of *C. hyperythrus schmidti* (1), *C. hyperythrus hyperythrus* (2), *C. bacatus* (3), *C. hyperythrus caeruleus* (4), *C. hyperythrus pictus* (5), *C. catalinensis* (6), *C. hyperythrus danheimae* (7), *C. hyperythrus franciscensis* (8), *C. hyperythrus espiritensis* (9).

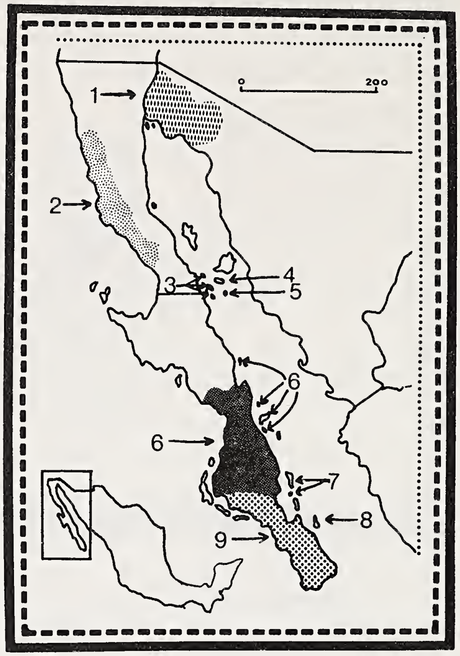

Fig.3. Distribution of *C. tigris punctatus* (1), *C. labialis* (2), *C. tigris canus* (3), *C. tigris estebanensis* (4), *C. tigris martyris* (5), *C. tigris rubidus* (6), *C. celeripes* (7), *C. ceralbensis* (8), *C. tigris maximus* (9).

Fig.4. Distribution of *C. tigris pulcher* (1), *C. tigris variolosus* (2), *C. tigris* sub. sp. (3).

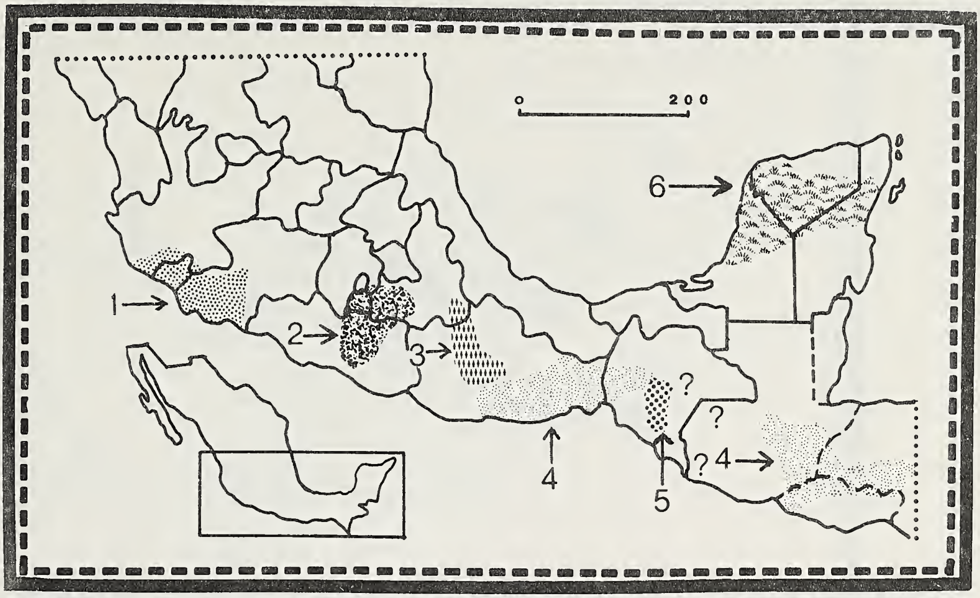

Fig.5. Distribution of *C. communis communis* (1), *C. sacki gigas* (2), *C. sacki sacki* (3), *C. motaguae* (4), *C. mexicanus* (5), *C. angusticeps angusticeps* (6).

Fig.6. Distribution of *C. costatus mazatlanensis* (1), *C. costatus huico* (2), *C. communis mariarum* (3), *C. costatus occidentalis* (4).

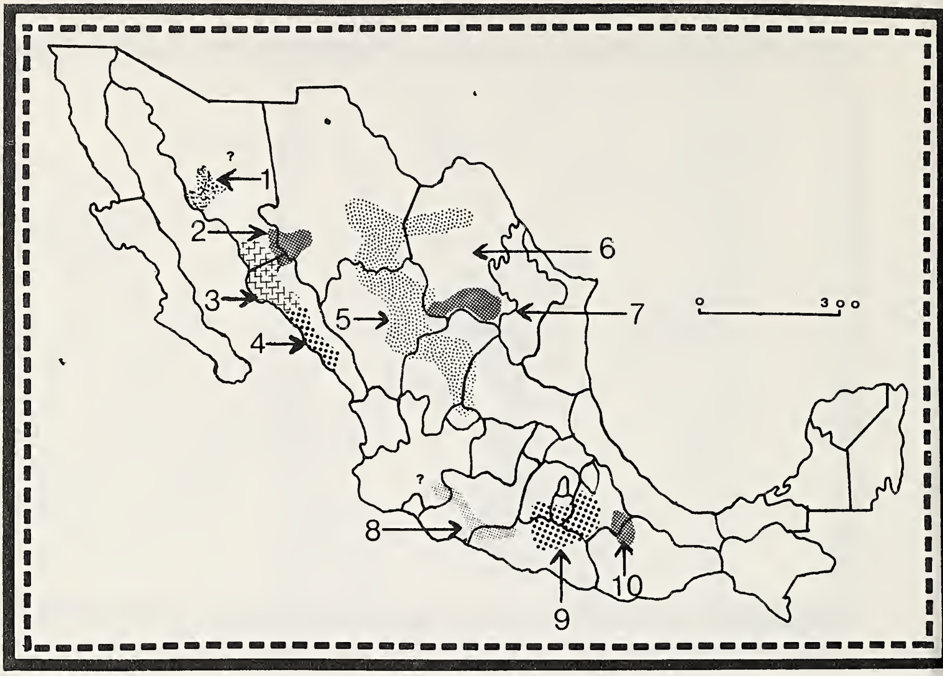

Fig.7. Distribution of *C. burti burti* (1), *C. costatus barrancorum* (2), *C. costatus griseocephalus* (3), *C. costatus nigrigularis* (4), *C. scalaris scalaris* (5), *C. scalaris pallidus* (6), *C. scalaris semifasciatus* (7), *C. costatus zweifeli* (8), *C. costatus costatus* (9), *C. parvisocius* (10).

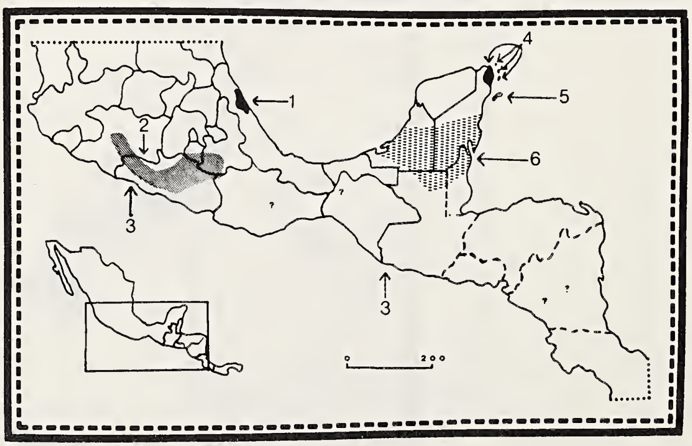

Fig.8. Distribution of *C. deppei schizophorus* (1), *C. deppei infernalis* (2), *C. deppei deppei* (3), *C. rodecki* (4), *C. cozumela cozumela* (5), *C. cozumela maslini* (6).

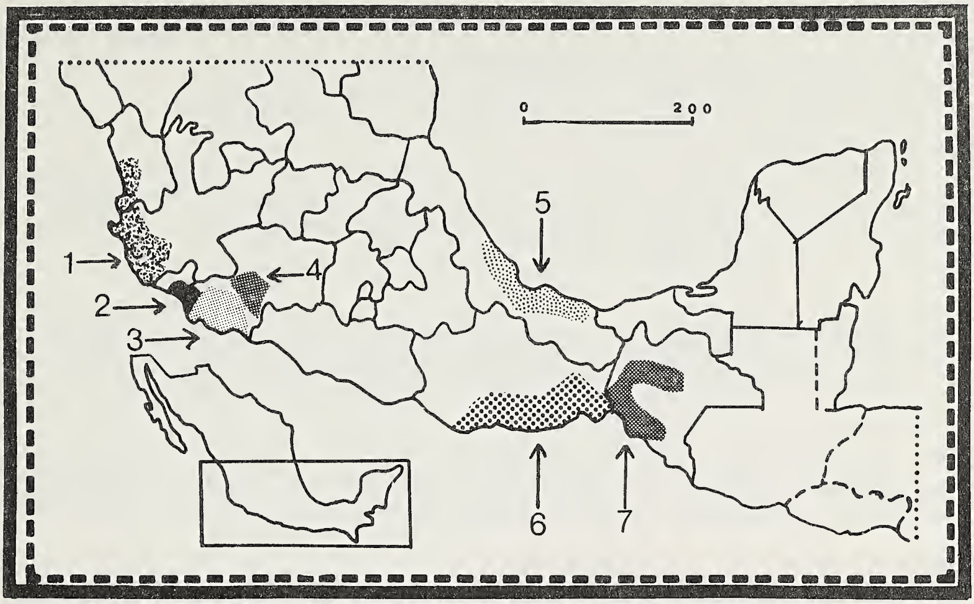

Fig.9. Distribution of *C. lineattissimus duodecemlineatus* (1), *C. lineattissimus lineattissimus* (2), *C. lineattissimus lividus* (3), *C. lineattissimus exoristus* (4), *C. guttatus guttatus* (5), *C. guttatus immutabilis* (6), *C. guttatus flavilineatus* (7).

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Notes

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THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

THE VENOMOUS SNAKES OF SOUTHERN AFRICA
PART II
ELAPIDAE AND HYDROPHIDAE

MDHS.......A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

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THE VENOMOUS SNAKES OF SOUTHERN AFRICA
PART 2
ELAPIDAE AND HYDROPHIDAE

By

W.R. BRANCH

As with vipers and pit-vipers, the familial or subfamilial relationships of terrestial elapids and sea snakes has been the subject of much debate. Although Smith (1926) in his monograph treated sea snakes as a family separate from the Elapidae, Underwood (1967) was more conservative, considering them as only a subfamily of the Elapidae. Recently McDowell, in a series of intensive studies on the relationships of elapids and sea snakes (1967, 1968, 1969a, 1969b, 1970, 1972), had demonstrated fundamentally different forms of palatine kinesis between sea snakes ("palatine draggers") and most terrestial elapids ("palatine erectors"). Surprisingly, Australian elapids are "palatine draggers", leading McDowell (1969, 1972) to postulate that sea snakes (with the exception of Laticauda, which he considers to have underone a separate marine radiation) are derived from the Australasian elapid radiation, most probably from the Demansia group. The Hydrophidae as thus recognised by McDowell (1972) includes sea snakes (other than Laticauda) as well as the terrestial Australasian elapids.

Such a drastic re-arrangement of the Elapidae is still a subject of active debate, although it has been formally accepted by Smith et al. (1977) in their recent classification. Fortunately it need not worry us too much here, as all researchers are agreed that African elapids form a natural group within the Elapidae.

In a stimulating paper, the importance of which seems to have been partly ignored by African herpetologists, McDowell (1968) has discussed the familial relationships of Elaps, the type genus of the Elapidae. The genus, which comprises only the two species lacteus and dorsalis, is endemic to South Africa. These small, brightly coloured snakes, which are somewhat confusingly known as dwarf

garter snakes, are largely fossorial, preying on small burrowing reptiles, and perhaps also termite larvae and eggs (FitzSimmons, 1962).

Although Elaps possesses a pair of deeply-grooved fngs, that are positioned on an otherwise toothless maxilla, and which are connected with a well-developed venom gland, McDowell (1968) has presented a suite of characters that differentiate the genus from all other elapids. Many of these characters are shared with aparallactine colubrids, particularly the genera Polemon and Chilorhinophis, and it is with these snakes that McDowell feels the true affinities of Elaps lie. This conclusion has been questioned by Kochva and Wollberg (1970), who have demonstrated that the venom gland of Elaps is histologically similar to that of elapids. Duvernoy's gland (from which McDowell derives the venom gland of Elaps), however, is very variable in aparallactines. Amblyodipsas unicolor and Xenocalamus mechowii have glands very similar to those of Dispholidus and Thrasops, respectively (Kochva and Wollberg, 1970). Similar glands in such completely unrelated snakes as these, must severely limit the taxonomic usefulness of this character in resolving the affinities of aparallactines to other snakes.

The close affinities that Elaps shares with aparallactines and elapids would be resolved if elapids evolved from an aparallactine or protoaparallactine stock. McDowell (1970) has suggested that Elapsoidea may be among the most primitive of existing elapids. It is perhaps not fortuitous that this fossorial elapid is widely distributed in the Ethiopian region, and like many aparallactines is a specialist feeder on fossorial reptiles. The absence in elapids of apical pits and a loreal are indicative of a fossorial ancestor, and aparallactines, unlike most other colubrids, lack both structures. This interesting subject has still to be satisfactorally resolved, and fresh lines of approach are currently being investigated (Branch, in prep.). The author feels, however, that McDowell (1968) has presented a good case for the removal of Elaps from the Elapidae, and these snakes will not be considered further in this paper. To avoid the taxonomic chaos that would ensue following the removal of Elaps (the type genus) from the Elapidae, McDowell (1968) has recommended that the two South African dwarf garter snakes, lacteus and dorsalis be known by the junior synonym Homorelaps Boulenger, even though this conflicts with nomenclatural rules. Dr. G. Underwood (in lit.) has informed me, however, that Homorelaps Boulenger is not a valid name, and if a junior synonym is to be used for these snakes it should more correctly be Homoroselaps Jan.

ELAPIDAE

Cobras, mambas and related elapids have undergone an extensive radiation in the Ethiopian region, with representatives occupying terrestial, fossorial, arboreal and aquatic niches. Nine genera, containing approximately 24 species, occur in the region. The majority of species are restricted to sub-Saharan Africa, although two species of Naja (haje and nigricollis) extend along the Nile valley into Egypt. The Egyptian cobra (N. haje) is also represented by a separate subspecies, arabica, in the Arabian peninsula. The rare desert elapid Walterinnesia aegyptia is mainly distributed in the Middle East, although a number of specimens, including the type which came from the vicinity of Cairo, are known from west of the Suez canel.

McDowell (1969) has suggested that Elapsoidea, Boulengerina and Paranaja are the most primitive of living elapids. The latter genus is monotypic, containing the single species multifasciata. Distributed in western central Africa, little is known of the biology of this rare snake. Its short (less than 600 mm), stocky build is indicative of a fossorial habit. The two species of water cobra, Boulengerina annulata and B. christyi, range through central Africa, from Tanzania to the Congo and Cameroun. Found only in or near water, they feed almost exclusively on fish. Despite their large size (over 2 metres) they are generally considered inoffensive to man, which is fortunate as no antivenin is produced for snakes of this genus.

With the exception of Walterinnesia, Boulengerina and Paranaja, the six remaining African elapid genera all have representatives in southern Africa, and the biology of these snakes will be considered in the following systematic account.

SYSTEMATIC ACCOUNT

Family: Elapidae

Subfamily: Bungerinae

Tribe: Najini

Key to Genera in Southern Africa

1. Preoculars (3) widely separated from nasal; prefrontals expanded laterally to touch labials; subcaudals over 90...... ....Dendroaspis

   Preoculars (1 or 2) in contact with nasal (except some Pseudohaje which may occasionally have a loreal); subcaudals less than 90 (except in Pseudohaje goldii which may reach 96)..2.

2. Rostral very large and shield-like, concave below and separated from other scales on sides..................Aspidelaps

Rostral not greatly enlarged or concave below, and in contact with other scales on the sides...........................3.

3. Dorsals distinctly keeled........................Hemachatus

Dorsals quite smooth...4.

4. Tail short; fewer than 40 subcaudals...........Elapsoidea

Tail moderately long, more than 45 subcaudals............... 5.

5. Eye very large; dorsals 13-15 rows at mid-body. Pseudohaje

Eye very small to moderate; dorsals in 17 (rarely 15 in Naja haje anchietae) or more rows at mid-body.........Naja

CORAL AND SHIELD-NOSE SNAKES

Aspidelaps A. Smith

These relatively small, robust elapids are instantly recognizable by their much-enlarged, shield-like rostral. Two species, lubricus and scutatus, each with three races, comprise the genus, which is restricted to southern Africa. Usually irrascible when first encountered, like cobras they rear up and flatten the neck region, which in lubricus may form a narrow hood. In common with Hemachatus, which is also a southern African endemic, the maxilla bears no teeth other than a pair of deeply-groved fangs, while scutatus also has keeled scales, and will sham death when threatened. These morphological and behavioral similarities may indicate a close relationship between the two genera.

Although usually considered relatively harmless, this belief may stem from their small size, and the presence of few published case-histories. However, A.l. infuscatus, at least, has a highly toxic venom, and is capable of inflicting a potentially dangerous bite.

In habits both species are semi-fossorial, and to this end the **enlarged** rostral may be likened to a bulldozer-blade, aiding the snake in burrowing through loose soil. This character is shared by a number of other semi-fossorial snakes, noticeable the colubrids Lytorhynchus and Phyllorhynchus. A. lubricus has a less well-developed rostral than scutatus, and this may be correlated with the more arid regions that it inhabits.

Key to the Aspidelaps of Southern Africa

1. Internasals in contact with one another behind the rostral; 3rd and 4th upper labials entering the orbit; scales smooth throughout..2.

Internasals completely separated by the very large rostral; 4th upper labial only entering the eye; scales keeled, at least on posterior half of body................................3.

2. Ventrals 142-168 (average 152, exceptionally over 160); subcaudals 20-28 (average 23); length of tail 9.2 to 10.2 times into total length; conspicuously banded or barred alternately with red and black..................lubricus lubricus

Ventrals 149-172 (average 158); subcaudals 28-36 (average 31); length of tail 7.3 to 9.6 times into total length; dirty white to greyish above, with blackish crossbands above usually less well-marked.............. lubricus infuscatus

3. Subcaudals 25-30 in males, 20-24 in females...scutatus scutatus

Subcaudals 32-39 in males, 27-33 in females................4.

4. Dark makings poorly defined; snout-vent length rarely exceeds 500 mm; ventrals 108-113 in males, 117-121 in females; subcaudals 32-35 in males, 27-31 in females.. scutatus intermedius

Dark markings clear and extensive; snout-vent length of adults often exceeds 500 mm; ventrals 114-120 in males, 118-125 in females; subcaudals 33-39 in males, 30-33 in females. ....scutatus fulafula

Aspidelaps lubricus lubricus (Laurenti)

Southern Coral Snake Fig. 2.

Identification:

A small, brightly-coloured snake, which may reach 750 mm in length, although adults usually average up to 600 mm. The enlarged rostral, that characterizes the genus, is not as large as in scutatus, although it still remains the most distinctive feature of the head, which is small and not distinct from the neck. The eye is of moderate size, and the 3rd and 4th upper labials enter the orbit. The body scales are smooth throughout, and in 19 rows at mid-body. Ventrals range from 142-168, but rarely exceed 160. The anal is entire, and the subcaudals 20-28. The tail is short.

Beautifully marked in alternating bands of orange to coral red and black (from which the snake derives its common name), it is possibly southern Africa's most attractive snake. 20-47 bands (15-39 on body, 3-10 on tail) occur, the first black band forming a broad nuchal collar, from which a forwardly-directed chevron extends onto the crown of the head. The black bands are always narrower than the red interspaces, and may form anteriorly-directed chevrons. The head is reddish, with a black crossbar between the eyes, that may extend through the eyes onto the labial margin. A second black crossbar may extend in a chevron over the head, connecting the angles of the mouth, although this may be reduced to two oblique bars on the posterior temporals. The ventrum is yellowish, except for at least the first two or three black crossbands, which completely encircle the body. Occasionally the remaining black crossbands extend, in paler form, across the ventrum. This is particularly so in juveniles, but fades with growth.

Distribution:

The race is endemic to the west and central regions of the Cape Province, South Africa (a single record from Smithfield in the southern Orange Free State requires confirmation), extending east as far as the Albany district.

Biology:

A semi-fossorial snake, restricted to sandy, arid regions, and emerging at night to forage. Apparently catholic in its diet, small rodents, lizards and even reptile eggs have been recorded as being consumed. Oviparous, nothing further is known concerning reproduction in the genus. Very irrascible when first captured, and rarely becoming completely tame in captivity, the snake rears up in cobra fashion, spreads a very narrow hood, and hisses dramatically. Nothing is known concerning the nature or toxicity of their venom (see infuscatus for what little data is available for the species.)

Aspidelaps lubricus infuscatus Mertens

Western Coral Snake, Fig. 3.

Identification:

A slightly larger snake (adults may reach 800 mm), that is not as brilliantly coloured as the typical race, and further distinguished in having more ventrals (149-172, average 158), subcaudals (27-36, average 31), and proportionately longer, and more pointed tail. All the brilliant orange/coral red colouration of the typical race has been lost, leaving a dull dirty white to yellowish, pinkish to smokey grey, or grey dorsum, the scales of which are usually dark-edged to give a checkered appearance. From 27-44 dark crossbars or transverse bars, extend along the body, although in northern specimens these may be greatly reduced, or even absent. The head may be

uniformly black, or pale with similar dark markings to those of the typical race. The dirty cream ventrum may bear dark vestiges of the anterior crossbars.

Distribution:

Throughout South Africa, from Great Namaqualand in the south to the Kaokoveld in the north. Another subspecies, cowlesi, characterized by an almost complete absence of pattern, broader head, and more pointed tail, occurs north of the Kunene river in southern Angola.

Biology:

Presumably as for the typical race, although perhaps slightly less fossorial. A large male when milked gave from 27-71 (mean 55) mg of wet venom (28% solid). Mice injected intraveniously initially showed distress, lack of coordination, and involuntary limb movements, then rapidly became semi-prostrate, with laboured breathing. Death followed shortly, presumably from respiratory failure (Branch, unpub. observ.). An LD50 of 317 mg/Kg was calculated, and in view of the venom yields obtained, it is obvious that infuscatus has the ability to inflict a potentially dangerous bite on man. Whether existing antivenoms will neutralize Aspidelaps venom is unknown. No documented case histories of bites of the Western Coral snake are known. However, a coral snake was found in a Bushman's hut in the Etosha Park, following the death of two children from snake bites received during the night (W. Haacke, pers. comm.) This anecdotal report emphasizes the findings of high toxicity for the venom of infuscatus, and its potential danger to man.

Aspidelaps scutatus scutatus (A. Smith)

Shield-nose snake, Fig. 4.

Identification:

A small, stocky snake, with a short, broad head, that bears a greatly enlarged, shield-like rostral, from which the snake derives its common name. The eye is of moderate size, with a single upper labial (4th) entering the orbit. Dorsal scales usually in 21 rows at mid-body, smooth or faintly keeled anteriorly, becoming strongly keeled posteriorly, and tubercular on the tail. Ventrals are slightly more numerous in females (115-122, mean 119) than males (110-118, mean 113), while the subcaudals show a well-defined sexual dimorphism (25-30, mean 28, in males; 20-24, mean 22, in females). The anal is entire. The dorsum ranges in colour from pale grey-brown or yellowish, to salmon pink or orange, with a series of usually ill-defined dark, dorsal blotches. The scales are often dark edged The head and neck are almost entirely black in adults, but in juveniles there are one or two white chevrons on the nape. The

ventrum is a uniform white.

Distribution:

In a wide belt extending across the northern regions of Southern Africa, from South West Africa in the west, through Botswana and southwestern Zimbabwe, into the north-western Transvaal. It is replaced in the eastern Transvaal and Mozambique by other subspecies.

Biology:

A snake of sandy, stony areas, it is semi-fossorial, spending the day in rodent burrows, or under loose stones or dead trees, beneath which it tunnels using its enlarged rostral like a bulldozer. It emerges at night, particularly after rain, to forage for food, eating small mammals and amphibians, but also lizards and occasionally snakes. When disturbed it rears up, lunging forward to strike, and giving an almost explosive hiss. A dramatic, though somewhat comic performance, albeit one that is potentially dangerous if the warnings are not heeded. Oviparous, although as with lubricus nothing further is known about their reproduction. No details of the yield, toxicity or composition of scutatus venom are available. Rose (1950) records the only identified bite by this genus. It produced in an adult male swelling of the arms for several days, which completely resolved.

Aspidelaps scutatus intermedius Broadley

Identification:

Similar in appearance and build to the typical race, but differing in a number of details of scutelation. In both sexes there are higher subcaudals (32-35, mean 33, in males; 27-31, mean 29, in females). As in typical scutatus dorsal scales rows are usually in 21 rows at mid-body, although a higher percentage (25%) have 23 rows at mid-body in intermedius. Colouration, and other aspects of scutellation are as for the typical race. Both races rarely exceed 500 mm.

Distribution:

Restricted to the eastern Transvaal, i.e. the area lying between the Drakensberg escarpment and the Lebombo Mountains.

Biology:

Pienaar's data for specimens from the Kruger National Park (which are referable to intermedius) reveal no differences from typical scutatus, adding only that they may be fond of moles--a snake having been found in a trap set for rodent- moles.

Aspidelaps scutatus fulafula (Bianconi)

Identification:

Differs from the previous races in its extensive dark markings, larger size, and higher subcaudal counts. Specimens may reach almost 750 mm in length, while subcaudals range from 33-39 (mean 36) in males, and 30-33 (mean 31) in females. The majority of specimens also have 23 rows of dorsals at mid-body, as opposed to 21 rows in the other races. The ground colour of the dorsum is pale buff, with a dorsal series of large, blackish, blotches, and extensive black blotches on the flanks that extend onto the ventrals. The ventrum is white, the head blackish, with white patches laterally.

Distrib ution:

The southern part of the Mozambique plain (but not extending into Zululand), and the Gona re Zhou in south-eastern Zimbabwe.

Biology:

Broadly (1968) (who recognized this subspecies) collected a series of specimens from shallow pans in the Gona re zhou National Park, following a December thunderstorm. It is possible that the snakes, all but one of which were collected at night, may not only have been foraging for food, but also searching for mates. Captive specimens ate mice and toads (*Bufo regularis*).

GARTER SNAKES

Elapsoidea Bocage

The common name of these small to moderate-sized, fossorial elapids, will cause some confusion to North American herpetologists, who usually associate the name with harmless natricines of the genus *Thamnophis*. However, the name, which presumably alludes to the banded colo ration of these elapids, is in common usage throughout east and southern Africa. The alternative of "burrowing cobra" is descriptive, but unfortunately already applied to *Paranaja*. The genus is widely distributed throughout sub-Saharan Africa, and somewhat of a taxonomic nightmare, due in no small part to the relative uniformity of scale counts in the genus, and the confusing ontogenic changes in colour pattern. Broadley (1971) has analyzed the genus throughout its range, stabilizing the taxonomy, and summarizing reproductive and feeding data. The following section draws heavily on his findings.

Six species are currently recognized in the genus, of which three, *guentheri*, *semiannulata* and *sundevallii*, occur in Southern Africa. *E. guentheri* shows affinities with *E. nigra* (a monotypic species, restricted to montane evergreen forest in northeast Tanzania, and which may be specialized for feeding on

caecillians), and inhabits forest-savanna mosaic in the lower Congo region, reaching its southern limit in Zimbabwe E. semiannulata inhabits dry savanna, and has the widest distribution in the genus, extending from Senegal in the west, through Congo-Kinshasa (represented throughout this region by the subspecies moebiusi), and down the eastern half of the region, through Tanzania, Zimbabwe and as far south as Kimberly in the Cape Province (the subspecies boulengeri). The southern species sundevallii inhabits open country including the South African highveld the Kalahari, and the south-eastern coastal plain. No less than 5 races occur in the region, and the probable evolutionary relationships of these forms have been discussed by Broadley (1971).

The remaining species, laticincta and loveridgei, are both extralimital; the former inhabiting dry savanna, from southern Sudan, west through northern Congo-Kinshasa to the Central African Republic; the latter being represented by three races colleti, scalaris and loveridgei) that inhabit evergreen forests and montane grassland regions around the great lakes of central Africa.

Garter snakes are relatively catholic in their diet, although most forms appear to feed predominately on fossorial reptiles, occasionally taking small mammals and amphibians. E. nigra may have a specialized diet of caecillians.

Little is known concerning the venom of these snakes. Very few bites have been reported, and these appear to be somewhat contradictory. All have involved intense localized pain, although this was not always assciated with swelling. Classic neurotoxic symptoms, when present, were of relatively minor consequence.

Key to the Elapsoidea of Southern Africa

Due to the relative uniformity of scale counts in the genus, and ontogenic changes in colour pattern, it is often difficult to identify individuals. Ideally series including males, females, and juveniles are required for accurate identification of populations. Knowledge of the locality will restrict the number of forms to be considered from any specific region.

1. Sexual dimorphism in ventrals not strongly marked (difference rarely more than 6); snout blunt to moderately pointed; range mainly north of Latitude 20 degrees S..........................2

   Males with much higher ventral counts than females (averaging 15 more); snout obtusely pointed; range south of Latitude 20 degrees S..4

2. Juveniles have 16-20 pale crossbands as broad, or broader than, dark bands; these markings usually not strongly contrasted and rarely persisting as paired transverse white lines in adults; snout rounded; usually four lower labials bordering the anterior sublinguals........................<u>guentheri</u>

Juveniles have 9-15 pale crossbands usually narrower than dark bands; these markings usually strongly contrasted and often persisting as paired white transverse lines in adults; snout moderately pointed; usually three lower labials bordering the anterior sublinguals (if 4, the fourth is usually in short contact)...3

3. Ventrum uniform white, sharply distinguished from dorsal coloration; range Angola and northern South West Africa, east to western Zambia ....<u>semiannulata</u> <u>semiannulata</u>

Ventrum usually grey to black, not sharply distinguished from dorsal coloration; range Mozambique north-west to Zambia, south through Zimbabwe and the Transvaal to Kimberley in the Cape Province........................<u>semiannulata</u> <u>boulengeri</u>

4. Juveniles and adults with 19-34 pairs of well-defined light transverse lines on body; range Natal to southeastern Transvaal..................................<u>sundevallii</u> <u>sundevallii</u>

Juveniles with 16-23 pale crossbands, adults usually devoid of markings...5

5. Subcaudals 19-23 in males, 13-20 in females.................6

Subcaudals usually 26-33 in males, 22-28 in females...........7

6. Ventrals 157-168 in males, 140-154 in females; range Transvaal, Orange Free State and northern Cape Province ....<u>sundevalli</u> <u>media</u>

Ventrals 167-180 in males, 156-161 in females; range Botswana and South West Africa................. <u>sundevallii</u> <u>fitzsimonsi</u>

7. Ventrals 152-159 in males; 138-144 in females; subcaudals 26-28 in males, 22-26 in females; range southern Mozambique and Zululand...........................<u>sundevallii</u> <u>decosteri</u>

Ventrals 164-179 in males, 148-156 in females; subcaudals usually 29-33 in males, 24-28 in females; range northern Transvaal, south-eastern Zimbabwe and adjoining Mozambique...<u>sundevallii</u> <u>longicauda</u>

Elapsoidea guentheri Bocage

Gunther's Garter Snake , Fig. 5.

Identification:

A small slender snake, rarely exceeding 600 mm, that has a rounded snout, and a short tail. The eye, which is relatively small, has a rounded pupil, while the scales, which are smooth and shiny, are in 13 rows at mid-body. Ventrals, unlike subcaudals, show little if any sexual dimorphism, males having 135-152, females 135-142. The anal is entire, and the paired subcaudals range from 19-24 in males, and from 17-19 in females. Juveniles black with 16-20 light bands (that are as wide, or wider than the black interspaces) on the body, and 2-4 on the tail. Snakes 300-400 mm long have usually lost all traces of these bands (which darken from the centre), although they may persist in some individuals as ill-defined paired white-dotted transverse lines. Adults are usually a uniform grey to black above, but paler below.

Distribution:

Usually associated with *Brachystegia* (miombo) woodland throughout the central watershed of Zimbabwe Extralimitally extending north-west to the forest-savanna mosaic of the Lower Congo region, reaching as far west as Cabinda.

Biology:

Like all other members of the genus, a shy secretive snake, that forages at night, spending the day under rocks or in burrows. Small snakes (*Aparallactus* and *Lycophidion*), skinks (*Riopa* and *Mabuya*) and amphibians have been recorded in the diet. Little is known concerning reproduction, save that a snake captured in January held 10 eggs.

Elapsoidea semiannulata semiannulata Bocage

Western Half-banded Garter Snake

Identification:

Perhaps the smallest member of the genus, the largest male measures 532 mm, the largest female only 467 mm. The snout is moderately pointed. As usual in the genus the dorsal scales, which are smooth and shiny, are in 13 rows at mid-body, while in approximately 70% of the race there are also 13 rows in the neck region. The ventrals (137-161 in males, 136-152 in females) show no well-defined sexual dimorphism. Sexual dimorphism, however, is apparent in the subcaudals (20-28 in males, 13-19 in females). The anal is entire, the subcaudals paired. Juveniles are black with 12-17 white bands (that are usually half the width of the black interspaces) on the body, and 2-3 on the tail. Ventrum (and often part of the outer scale row) uniform white. The white bands begin to darken from the center when

the snake is c. 200 mm, to form a pattern of well-defined paired white transverse lines, that persists in snakes up to 450 mm. In larger snakes even these white lines may become faint.

Distribution:

Inhabiting upland savanna between 500-2000 metres throughout Angola, southwestern Congo-Kinshsa, western Zambia, and only entering the area of discussion in northern South West Africa, including the Caprivi Strip.

Biology:

Similar in most respects to that of guentheri. Usually inoffensive, if provoked they will coil and hiss, but do not flatten the neck region. Although possessing a small gape, being front-fanged they can give an effective stab-bite. Fortunately their venom appears mild, although painful.

Elapsoidea semiannulata boulengeri Boetger

Boulenger's Half-banded Garter Snake Figs. 6 and 7

Identification:

Similar to the typical race, with the exception that ventrals range from 140-161 in males, and 138-155 in females, and that subcaudals range from 18-27 in males, and 14-21 in females. In addition only 8% of the snakes have 13 rows of scales in the neck region, the vast majority having 15 rows. Juveniles have 8-17 white or lemon yellow bands on the body and 0-3 on the tail, only half to one third the width of the black interspaces. The head is white, with a prolongation of the black nape band extending forward along the parietal suture onto the frontal. Chin and throat white, rest of ventrum usually dark grey, sometimes bordered with a white lateral strip. A few specimens (mainly from southeastern Zimbabwe have a uniform white ventrum. The light bands darken from the centre when the snake reaches c. 200mm, persisting as paired white transverse lines until c. 300 mm, when they usually disappear, although persisting in some populations, e.g. central Mozambique.

Distribution:

Inhabiting savanna from sea level upto 1500 metres. Southeastern Africa, from southern Tanzania south to southern Mozambique (but not yet recorded from Zululand), extending west to Zambia, and again south throughout Botswana, Zimbabwe and the Transvaal, reaching as far south as Kimberly in the Cape Province.

Biology:

Often associated with open flood plains and mopane woodland, its biology is similar to that of the typical race. Specific food items include; the amphibians Breviceps, Phrynomerus, Hemisus and Afrixalus; the skinks Mabuya and Afroablepharus; and the snakes Crotaphopeltis and Causus. Oviparious, from 4-8 eggs being recorded.

Elapsoidea sundevallii sundevallii (A. Smith)

Natal or Sundevall's Garter Snake Fig. 8.

Identification:

The largest species of *Elapsoidea*, characterized by an obtusely pointed snout, with the rostral broadly visible from above. There is a surprising sexual dimorphism in size, males being almost half as big again as females (maximum snout-vent length, male 930 mm, female 580 mm). Associated with this males have more ventrals (163-181) than females (147-156), and also have more subcaudals (males, 20-28; females 16-21). The anal is entire, subcaudals paired, and scales in 13 rows at midbody. Juveniles have 19-34 clearly-defined white-edged pale brown bands on the body and 2-4 on the tail, that are narrower than the slate-grey interspaces. The head is pale, with a dark forward prolongation of the nape band onto the frontal. The ventrum pale brown mesially, bordered with cream. Adults over 500 mm snout-vent length retain well-defined pairs of light transverse lines.

Distribution:

Savanna from sea level to about 1600 metres on the eastern plateau slopes of Natal, southeastern Transvaal and Swaziland.

Biology:

As for other members of the genus. FitzSimons (1962) recorded lizard eggs (especially gecko's) in the stomach contents, while a Natal snake contained an amphibian (*Breviceps*). Presumably oviparous, no reproductive data exists for any races of the species.

Elapsoidea sundevallii media Broadley

High-veld Garter Snake . Fig. 9.

Indentification:

A small race (largest male 590 mm) in which the obtusely pointed rostral is more prominent than in any other form of *Elapsoidea*. Ventrals (males 157-168; females, 140-154) and subcaudals (males, 19-23; females, 13-18) are fewer than in the typical race. Juveniles have 16-23 clearly defined pinkbands on the body and 2-3 on tail, about three-quarters width of black interspaces. Head pale, with black forward prolongation onto frontal. Ventrum and lower half of outer scale row pale brown. The pale bands, which may still be faintly visible in snakes over 400 mm, but absent in larger snakes, appear to darken from the edges of each scale, and do not form pairs of white transverse lines.

Distribution:

The high-veld grasslands (1250-1800 metres) of the Transvaal and Orange Free State, extending into the northern Cape Province at Kimberley.

Biology:
As for other members of the genus.

Elapsoidea sundevallii fitzsimonsi Loveridge

FitzSimons' Garter Snake

Identification:
A western form, similar to neighboring media in having low subcaudals (males, 22-23; females 17-20) but differing in its higher ventral counts (males 167-180; females, 156-161). Juveniles have 18-21 white crossbands on the body and 2-3 on the tail, subequal in width to black interspaces, but narrower laterally. Ventrum and outer row of dorsals uniform white. All traces of dorsal bands disappear before snout-vent length reaches 375 mm.

Distribution:
Inhabiting wooded steppe on Kalahari sand (900-1500 metres) in South West Africa and western Botswana, extending into the Kalahari Gemsbok National Park (Cape Province).

Biology:
Presumably as for other forms. Recorded in the vicinity of vleis and pans, a Kalahari Gemsbok National Park snake contained a snake--Psammophis leightoni trinasalis.

Elapsoidea sundevallii longicauda Broadley

Long-tailed Garter Snake

Identification:
A northeastern race characterized (as its name implies) by its longer tail (subcaudals; males 21-33; females 24-28). Its ventral counts (males 164-179; females, 148-156) are similar to those of neighboring fitzsimonsi, but higher than adjoining media and decosteri. A male from Mapinhane, Mozambique, is the largest known Elapsoidea (1290 + 90 =1380 mm). As with all other races of sundevallii the majority of specimens have 15 scale rows on the neck, reducing to 13 rows at mid-body. Juveniles have 17-20 buff crossbands on the body and 2-3 on the tail, about two-thirds width of black interspaces. Head white with a black median marking which reaches the anterior edge of the frontal. Ventrum and (usually) outer scale row uniform white. The light bands begin to disappear in snakes of 3-400 mm, with no development of paired white transverse lines. Adults are uniform black above, outer scale row pink with a white ventrum, and a salmon pink outer row of dorsals.

Distribution:
Inhabiting dry savanna on deep aeolian or alluvial sands

from sea level to about 900 metres, in the Northern Transvaal, southeastern Zimbabwe and adjoining Mozambique.

Biology:

Sympatric with semiannulata boulengeri around the Malugwe Pan in the Gona re zhou National Park, southeastern Zimbabwe, The larger size of sundevallii longicauda may allow the adults to exploit different food resources to that of boulengeri, thus reducing ecological competition. This may be indicated by the discovery of two Malugwe Pan longicauda in the runs of golden moles (Amblysomus obtusirostris). Captive specimens have fed on snakes, while a skink was found in the stomach of a Transvaal snake.

Elapsoidea sundevalli decosteri Boulenger

De Coster's Garter Snake

Identification:

A southeastern race, with a very restricted distribution, it differs from neighboring longicauda in having fewer ventrals (males, 152-159; females 138-144), and from adjoining media and sundevallii in having more subcaudals (males 26-28; females 22-26). Juveniles with 19-21 white-edged pale brown bands on the body and 3-4 on the tail, subequal to or slightly narrower than the darker interspaces. A dark lancehead mark on the crown covers most of the parietals and frontal. Ventrum and outer row of dorsals uniform white. The light bands persist as paired white transverse lines up to a snout-vent length of c. 320 mm, then disappear entirely.

Distribution:

Restricted to coastal alluvium from sea level to about 100 metres, in the extreme south of Mozambique and adjoining northern Zululand.

Biology:

As for typical sundevallii.

MAMBAS

Dendroaspis Schlegel

Next to the Puff adder, mambas are perhaps the most characteristic venomous snakes of Africa. Due to their large size, alert movements, and toxic venom, which is produced in copious amounts, these snakes are justifiably feared. Fortunately, being diurnal, and for the most part arboreal (the exception being polylepis which is mainly terrestial) they rarely come into contact with man, and bites are infrequent. The large fangs of Dendroaspis (which are not proportionately longer than in other elapids) may reach a length of 7-8 mm, and are borne on the

front of an otherwise toothless maxilla. There is an exceptional degree of maxillo-prefrontal articulation, which allows the fangs to be very effectively used for delivering quick stabbing bites.

Only four species are currently recognized in the genus, which ranges throughout tropical Africa, extending from Somalia to Senegal, and south to the Transkei in southern Africa. The three green mambas, angusticeps, jàmesoni and viridis, are all arboreal and for the most part restricted to tropical rain forest. Jamesoni and viridis are west African species, the latter being restricted to the forests from Gambia to Dahomey, and unlike the former, which ranges from Ghana to western Venga and Angola, does not cross the Dahomey gap.

D. angusticeps is represented in southern Africa by isolated populations in the lowland forest and bamboo thickets of the eastern coastal plain, reaching as far south as northern Transkei. To the north it ranges as far as Kenya. D. polylepis is the widest ranging mamba, and throughout its range is basically terrestrial, favoring rocky outcrops in thick bush, and riverine forest at low altitude. For a long time these two species, known respectively as the "green" and "black" mambas, were considered as simple color variants, and that the green coloration was lost by large adults. However, in 1946, Dr. V. FitzSimons demonstrated that two species were involved, and that the larger black species (polylepis) could be further distinguished by the dark lining to its mouth, and more numerous ventrals and mid-body scale rows.

Key to the species of Dendroaspis in Southern Africa

1. Scales usually in 23-25 rows at mid-body; ventrals 242-282; inside of mouth blackish; adults olive brown to dark brown but never bright green........................polylepis

   Scales usually in 19 rows at mid-body; ventrals 201-232; inside of mouth white to bluish white; adults bright green...angusticeps

Dendroaspis polylepis Gunther

Black Mamba Fig. 10 and 11.

Identification:

By far the largest venomous snake in Africa, adults usually average 2.5 - 3.0 metres in length, and exceptional individuals may exceed 4 metres. Although commonly called the black mamba, this is somewhat of a misnomer as individuals are usually brown to grey, or even olive green, with often a heavy mottling of darker markings (which may form oblique crossbars) on the posterior half of the body. The ventrum is a greyish white, often tinged with yellowish or greenish, and again frequently

with darker mottlings towards the tail. The head is elongate and square-sided and has been aptly, although perhaps dramatically, called 'coffin-shaped.' The 3 preoculars are widely separated from the nasal by the enlarged prefrontal that contact the labials, and of the 7-10 upper labials only the 4th (usually) enters the eye. There is no sexual dimorphism in either the ventrals (242-282) or subcaudals (105-131). The anal is divided. The scales are smooth and usually in 23-25 rows at mid-body.

Distribution:

In southern Africa the black mamba is widespread throughout the lowveld areas of the Transvaal and Zimbabwe, particularly along the valleys of the major rivers. Extending down the coastal plain of Natal, it reaches as far south as southern Transkei. Skirting the northern boundry of the Kalahari it ranges throughout the central and northern regions of South West Africa , thence northwards through Angola to the lower Congo. Along the east coast of Africa polylepis extends into the Horn and Eritrea. This northern form, extending as far south as northern Kenya, has been recognized as a separate subspecies (antinorii Peters), characterized by a small 2nd upper labial that is not in contact with the prefrontal, and having 25 scale rows at mid-body. The northern Kenya--southern Somalia region is poorly collected, and whether such relatively minor differences will simply form the extremes of a cline only further collecting will resolve. It is likely, however, that polylepis is monotypic (Broadley, pers. comm.).

Biology:

A large, active diurnal predator, the black mamba forages for its prey among the undergrowth of rocky outcrops and riverine forest. Often associated with specific territories, a mamba may have a favored resting place, such as a disused termite's nest or hollow tree, to which it will return each night. Of catholic tastes, mammals, birds and possibly even reptiles form its diet, although there appear to be no reliable records of the latter. These are actively pursued, the mamba giving numerous quick bites until the potent neurotoxic venom immobilises the prey.

Oviparous, up to 14 large (70 X 35mm) elongate eggs are laid in November-December, the new-born young measuring from 400-600mm in length.

When foraging the mamba often carries as much as the front third of its body off the ground. Even in this position it can move speedily, and it is a frightening experience to be confronted with such an adversary, for even an average-sized mamba may rear its head as much as a metre from the ground. However, the famed aggressiveness of the black mamba is greatly exaggerated, and the author still vividly recalls the occasion when a mamba, disturbed whilst foraging near a granite koppie, sped off through the undergrowth and actually passed between the legs of an African assistant, but made no attempt to bite. When

cornered, a mamba will rear up, gaping to display the black lining of the mouth, and spreading a narrow hood. Emitting a hollow-sounding hiss, any unwise movement on the part of the intruder is likely to be met with a quick, powerful strike. The venom, like that of most elapids, contains a powerful neurotoxin, that effects a peripheral blockade of nerve endings, death ensuing from respiratory collapse. 10-15 mg of venom is fatal to humans, and as much as 100-400 mg of venom may be delivered in a single bite. Such a toxic venom, injected in large amounts, often on the torso of the victim, and deep into the tissues due to the large size of the fangs, results in a rapid and serious envenomation. Until the advent of high-titre mamba antivenin the prognosis of such victims was very poor, and resulted in almost 100% fatality.

Dendroaspis angusticeps (A. Smith)

Eastern Green Mamba Fig. 12.

Identification:

A smaller snake than the black mamba, rarely exceeding 2 metres in length, and of generally lighter build. It may also be distinguished by the fewer rows of scales at mid-body (17-21, usually 19), lower ventral counts (201-232), white to bluish-white mouth lining, and bright green coloration. The head scalation is similar to that of polylepis, the anal is divided, and the paired subcaudals range from 99-126, and show little evidence of sexual dimorphism. The adult coloration is a brilliant emerald green, sometimes with scattered yellow scales. The ventrum is yellowish-green. Juveniles are bluish green.

Distribution:

Inhabiting the East African coastal plain from Kenya to southern Natal. In the area under discussion it reaches its furthest point inland in the scattered remnants of rain forest along the Zimbabwe--Mozambique border.

Biology:

A completely arboreal species, that previously inhabited the lowland evergreen forests of the eastern coastal plain of southern Africa, but which seems to survive relatively well in the tea, mango and sugar-cane plantations that have replaced much of its former habitat. Feeding apparently solely on warm-blooded prey (small mammals and birds), neither arboreal lizards or amphibians are eaten. Oviparous, up to 10 white, elongate eggs (measuring 65X35mm) are laid in October-December in hollow trees or leaf litter.

Shy and elusive, it is much more placid than the black mamba, and only rarely threatens by gaping. It will strike if molested but fortunately the venom is considerably less

toxic than that of polylepis, in additon to being injected in smaller quantities (60-100mg). Symptoms of the few bites recorded have involved mild neurotoxic signs, that readily responded to antivenin, or even resolved themselves without such treatment.

RINKALS

Hemachatus Flemming

A monotypic genus, containing the single species haemachatus. A southern African endemic, ranging as far north as Zimbabwe, it is readily distinguished from the closely-related Naja, by its keeled scales, the absence of solid teeth on the maxilla, and in producing live young. It is famed for its ability to spit venom, a characteristic that it shares with four other African species of Naja.

Hemachatus haemachatus (Lacépéde)

Rinkals Figs. 13 and 14.

Identification:

A medium sized elapid that averages about a metre in length, although exceptionally may reach 1.5 metres. It is robust, with a short tail and a pointed head that is not distinct from the neck. The scales on both body and tail are strongly keeled, and arranged in 19 (17-19 in Zimbabwe) oblique rows at mid-body. There is little indication of sexual dimorphism in either the ventrals (116-150) or paired subcaudals (33-47). The anal is entire. The head bears 8-9 lower labials, and 7 upper labials of which the 3rd and 4th enter the orbit. The coloration is somewhat variable. The dorsum may be black to dark brown, spotted, variegated or with irregular bands of creamy white to yellowish or pale brown (the banded pattern is particularly common in the eastern Cape Province and Eastern Zimbabwe); or brown above, uniform or spotted with black. The ventrum is dark brown to black, usually with 1-2 pale crossbands on the neck, the anterior of which is usually narrower (1-2 ventrals) than the posterior (up to 7 ventrals). In some specimens these bands fade with age. In Zimbabwean specimens the stretched skin between the scales on the neck is bright vermillion or yellow.

Distribution:

Basically restricted to the eastern regions of South Africa, ranging from the southern Cape Province, northeastwards through the Orange Free State, Lesotho, Transkei, Natal, western Swaziland and Transvaal (although absent from the western and northern Transvaal). There is an isolated population centered around Inyanga on the Zimbabwean Mozambique border, and a single (probably doubtful) record for Charre on the Zambezi in Mozambique.

Biology:

Basically nocturnal, although occasionally basking during the day, the rinkals is relatively catholic in its diet; taking small mammals, birds, and large numbers of toads. Inhabiting a wide variety of habitats, from sea level to over 2,500 metres, in some regions (e.g. the highveld of southeastern Transvaal) it is particularly common. Unique among African elapids in being viviparous, it gives birth to 20-30 (exceptionally 60, but as few as 9 in Zimbabwe young, from 160-170mm long, in January-March.

When distrubed, a cornered rinkals has the ability to spit venom accurately (and usually at the head of an intruder) a distance of 2-3 metres. Venom entering the eyes of the intruder causes intense pain and temporary blindness, thus allowing the rinkals to make its escape. Should this fail the rinkals can sham death, rolling onto its back with its mouth agape, in a posture very similar to that undertaken by the harmless hog-nose snakes (Heterodon) of North America, or the grass snake (Natrix natrix) of Europe. If the intruder is fooled by this performance and departs, the rinkals will slowly turn onto its belly and crawl away. The venom is less toxic than most other African elapids, and human envenomation responds promptly to polyvalent antivenin, and fatalities are rare.

TREE COBRAS

Pseudohaje Gunther

The inclusion of tree cobras in this discussion rests solely on Mertens' (1955) report of a single specimen of P. goldii from Okavango, on the northern border of South West Africa. However, considerable doubt exists as to the correct identity of this specimen, which is based on a headless skin, that moreover also has a truncated tail. The brownish skin has glossy scales in 15 rows at midbody, and presumably on this basis was assigned to Pseudohaje. However, Naja haje anchietae also occasionally has 15 scale rows at mid-body, as do some species of Grayia (i.e. tholloni and caesar, whilst smythi and ornata usually have 17 rows at mid-body, but may be expected to occasionally have only 15 rows). The possibility that this problematic skin may indeed represent a specimen of Grayia is strengthened by the aquatic habitat of the Okavango from which it was collected.

The species, goldii and nigra, comprise the genus Pseudohaje; the latter being basically restricted to the Liberian forest, from Sierra Leone to Togo; the former having a wider distribution in the Congolese forest, ranging from Nigeria to Kenya, and south to Angola possibly as far as the Okovango. Recently Hughes (1976) has shown that both species are sympatric at two localities in Ghana, whilst nigra also extends as far east as Enugu in Nigeria. Both

species are similar in appearance and ecology. Adults average 2 metres in length, exceptionally reaching 2.5 metres. The head is short and narrow, and only slightly distinct from the neck, whilst the tail is long. The eye is very large, and the single elongate preocular may occasionally have a vertical suture to form a "loreal." The body scales are large and glossy, and in only 13-15 rows at mid-body. The last four characteristics readily distinguish Pseudohaje from cobras and mambas. Able to spread only a very narrow hood at most, tree cobras are considered dangerous although very little is known about their venom, and bites are very rare, due to their arboreal habits. A sample of venom tested by the South African Institute for Medical Research (Annual Report, 1970) was, however, among the most toxic they have tested. As tree cobras do not normally range into the area of discussion, they will be considered no further.

COBRAS

Naja Laurenti

The genus Naja comprises some 6-9 species, that are widely distributed throughout Africa (excluding the Sahara) and southeastern Asia, and is also known from Upper Miocene deposits in France (N. romani). The taxonomy of Naja in Asia is chaotic. Most authors conservatively place all Asian cobras (with the exception of the King cobra, Ophiophagus hannah) in the species N. naja, recognizing a number of races, i.e. oxiana, kaouthia, atra, sputatrix, miolepis and phillippinensis. Others, notably Deraniyangala (1960, 1961), recognize 3-4 species and many more races. Fortunately the taxonomy of African Naja is in a much healthier condition, mainly due to the studies of Broadley (1968 & 1974). Currently 7 species are recognized, all but two of which occur in southern Africa. The exceptions, katiensis and pallida were treated by Broadley (1968) as subspecies of the eastern spitting cobra mossambica, although the ranges of all three forms do not adjoin.

Roman (1969) has demonstrated that in Upper Volta, where the ranges of katiensis and the western spitting cobra nigricollis overlap, that the forms act as good species. An inhabitant of the sub-Saharan Sudan savanna belt, katiensis extends from Senegal to Nigeria.

Of the remaining species, the Cape Cobra, N. nivea, is the most well-defined, being endemic to southern Africa. Although occuring in a variety of color forms, no races are recognized. The forest cobra, N. melanoleuca, is widely distributed in forested or formerly forested areas, from Senegal to Natal, South Africa. Laurent (1955) recognized a savanna race, subfulva, but this has been rejected by Broadley (1968). The Egyptian cobra has an unusual distri-

bution in Africa, and four races are recognized (Broadley, 1968). Typical haje is widespread in northeastern Africa, extending along the Nile valley, and both north and south of the Sahara to the Atlantic coast. In east Africa it is patchily distributed, reaching its southern limit in northern Tanzania. The subspecies N. h. arabica is distributed in the semi-desert of western and southern Arabia. The Egyptian cobra is absent from the forest belt of central Arica, but represented in southern Africa by western (anchietae) and eastern (annulifera) races, that intergrade in northwestern Zimbabwe.

The spitting cobras of Africa were long considered to comprise a single species, with a number of races. However, it is now known that these forms, which may be termed the nigricollis complex or superspecies, comprise at least four species (nigricollis, mossambica, pallida and katiensis). Broadley (1968) originally considered nigricollis to be monotypic, but recognized 5 races of mossambica (woodi, nigricincta, pallida, katiensis, and typical mossambica). However, he later transfered the races woodi and nigricincta to nigricollis, after discovering sympatry between mossambica and nigricincta at Maconjo in Angola (Broadley, 1974), whilst Roman (1969) elevated katiensis to full species.

Pallida is restricted to north-eastern Africa, and spearated from mossambica in the south by an intervening population of nigricollis nigricollis. Like katiensis it probably deserves specific recognition. Both mossambica and all three races of nigricollis occur in southern Africa.

All cobras are large snakes, ranging in length from 1.5 - 3.0 metres, stockily built, and with smooth scales. They are all capable of rearing the forepart of the body and spreading a hood, although this is not so well-developed in melanoleuca. There are differences in the toxicity and nature of the venoms of African Naja, and it now appears that the less-toxic venoms of the spitting cobras nigricollis and mossambica are not neurotoxic, but rather produce local swelling and necrosis, haematological abnormalities and complement depletion. Conversely the venoms of the non-spitting cobras haje, melanoleuca, and particularly nivea, contain a powerful neurotoxin and death usually results from respiratory failure.

Key to the Naja of Southern Africa

1. Upper labials usually excluded from the orbit by suboculars .... 2.
   One or two upper labials entering the orbit............. 3.

2. Scales usually in 17 rows at mid-body

   ....haje anchietae

Scales usually in 19 rows at mid-body.........*haje annulifera*

3. Sixth upper labial largest and in contact with the postoculars; a single preocular ....4.
Sixth upper labial not the largest and not in contact with the postoculars; two preoculars................................5.

4. Rostral about as broad as deep; internasals as long as the prefrontals....................................*nivea*
Rostral much broader than deep; internasals shorter than the prefrontals....................................*melanoleuca*

5. Mid-body scale rows 23-25, usually 23; dorsum pale grey to olive brown, with dark-edged scales; ventrum salmon pink to cream, with a series of black bands or blotches on throat. ....*mossambica*

Mid-body scale rows 17-21 (except occasionally 23 in some South West Africa specimens); dorsum either uniform dark olive to black, or dirty white, olive or reddish with numerous narrow black crossbands; ventrum yellow to pink, or grey to black, with a single broad dark band on throat...6.

6. Dorsum uniform dark olive to black.........................7.
Dorsum dirty white, olive or reddish with numerous narrow black crossbands; northern half of South West Africa and southwestern Angola, extending along the coast as far north as the Cuanza River.........................*nigricollis nigricincta*

7. Ventrals 216-228; southern South West Africa south to Citrusdal, Western Cape Province...................*nigricollis woodi*
Ventrals 182-196; Caprivi Strip ....*nigricollis nigricollis*

Naja haje annulifera Peters

Banded Egyptian Cobra Figs. 15 and 16.

Identification:

A large snake, adults averaging nearly 2 metres, and occasionally reaching 2.5 metres. The body is moderately stout, but tapers gently to a moderately long tail. The rather broad head is flattened, has a rounded snout, and is only slightly distinct from the neck. The scales are smooth, with a dull sheen, and in 19 (occasionally 21) rows at mid-body. The moderately large eye has a round pupil and is separated from the upper labials (7-8) by 2 or 3 suboculars. There is little indication of sexual dimorphism in either ventrals (males, 175-201; females; 180-203) or subcaudals (males; 51-64; females, 55-65). The anal is entire. The head is dark brown to black, with a yellow chin; dorsum grey-brown, dark grey or blue-black (rarely yellow or reddish with pink interstitial skin); ventrum

yellow, mottled with brown, often darkening to uniform blackish; a broad (6-12 ventrals) dark brown band is always present on the throat. A banded phase (after which the race is named) occurs sporadically throughout the range, and is surprisingly apparently partially sex-linked, about 70% of banded cobras being males.

The head is brown, body blue-black with 7-11 bright yellow to whitish crossbands, which are usually half the width of the black interspaces; ventrum uniform yellow, or more often blotched with black opposite the black interspaces (rarely completely ringed in yellow and black). Subadults are more brilliantly colored, being dull yellow and bright yellow except for the jet black throat band.

Banding is barely discernible on hatchlings (300mm), but is fully developed at 600 mm.

Distribution:
An eastern race found throughout most of Zimbabwe (except northwest) and the Transvaal, extending south to Zululand and along the extreme eastern region of Botswana to the northern Cape Province. Northern limit unclear; present in Zambezi valley, and Shire valley of Malawi.

Biology:
A basically savanna species, found at altitudes from sea level up to 1,600 metres, and particularly common in bush and lowveld. Frequently found in disused termite's nests, they are nocturnal, emerging at night to forage on a wide variety of prey. They often establish preferred retreats, outside which they may be found basking in the early morning sun. Lizards, snakes, small mammals, amphibians, and birds and their eggs are all readily taken, although toads seem the staple diet. Oviparous, 8-25 eggs (55mm X 25mm) are laid in loose soil or disused termitaria, the hatchlings measuring about 300mm in length.

When disturbed, and unable to retreat, it adopts the classic cobra posture, spreading a broad hood. Like the Rinkals it may also sham death, even allowing itself to be handled. It is not, however, able to spit venom. Bites may be relatively common in some districts, and often occur on the lower leg when the snake is distrubed at night, whilst foraging around houses for food. A burning pain and slight swelling are the first indications of envenomation, followed in serious cases by a rapidly developing sequence of neurological disturbances, culminating in untreated cases with respiratory failure and death. Venom yields may range from 175-300 mg, of which from 25-35 mg may be fatal in humans.

Naja haje anchietae Bocage

Anchieta's Cobra

Identification:

A large, thickly-built snake, with a short wide head, that is not distinct from the neck. The eye is moderately large, with a round pupil, and is separated from the upper labials (7-8) by 3 or 4 suboculars. The scales are smooth, with a dull sheen, and usually in 17 rows at mid-body. The tail is moderately long. There is little indication of sexual dimorphism in the paired subcaudals (males; 56-60; females, 54-66), but females may have slightly more ventrals than males (females 187-195; males, 182-190). The anal is entire. The coloration is similar to that described above for *annulifera*. A banded form occurs very occasionally. Adults average 1.5-1.7 metres, but may reach 2.1m.

Distribution:

Southern Angola, northern South West Africa, western and central Botswana, northwestern Zimbabwe, and western Zambia.

Biology:

Inhabiting dry savanna in the west, it is often associated with swamp or flood-plain conditions in the east. Its biology is similar to that of *annulifera*,

Naja melanoleuca Hallowell

Forest Cobra Fig. 17.

Identification:

The largest of southern African cobras, with a maximum recorded size of 2690mm, although most adults average 1.8-2.1 metres. Of slender build, it is easily distinguishable from other cobras by the highly-polished dorsal scales. The head is blunt and hardly distinct from the neck, and the moderate to small eye has a round pupil. There are 7 upper labials (3rd and 4th entering orbit) and 8 lower labials. Sexual dimorphism in both ventrals (197-226) and paired subcaudals (57-74) is ill-defined, whilst the mid-body scales are in 19 (occasionally 17 or 21) rows. The anal is entire. The head and fore-part of body yellowish-brown, heavily-flecked in black and occasionally white, that becomes increasingly more dense until the latter half of the body and tail are often uniform black; ventrum bright yellow to creamy-white, heavily blotched with black; some, or all of labials white to yellowish-white, edged with black (from which it derives its other common name--black-and white-lipped cobra).

Distribution:

Similar to that of the green mamba and Gaboon adder, occuring in the forested areas (or previously forested areas) of the easern border of Zimbabwe into northern Natal, as far south as Mtunzini. Extralimitally extending as far as Senegal and western Ethiopia.

Biology:

Although known by the common name Forest cobra this snake appears to adapt readily to deforestation, living in the tea and sugar cane plantations that replace the evergreen forests. Its diet is varied, consisting of small mammals, birds, toads and other snakes. In addition it takes readily to water, and has been reported feeding on slow-moving fish, such as catfish (*Clarias*).

Oviparous, up to 26 eggs (60 X 30mm) are deposited in hollow trees, under rotting logs, etc. Like other southern African cobras, it will when molested spread a long narrow hood. Its venom is intermediate in toxicity between that of *haje* and *nivea*, and like these two venoms basically neurotoxic. Although fatalities have been reported elsewhere in Africa, few bites have been recorded in Southern Africa, presumably because of their restricted distribution and shy habits .

Naja nivea (Linnaeus)

Yellow or Cape Cobra Fig 18.

Identification:

A relatively small (adults rarely reach 2 metres in length), slender cobra, with a head broader than the neck, moderate-sized eye, and round pupil. Of the 7 upper labials the 3rd and 4th enter the orbit. There are 9, occasionally 8 or 10 lower labials. There is no sexual dimorphism in either ventrals (195-227) or paired subcaudals (50-68), and the anal is entire.

Mid-body scales in 19-21 rows, smooth but with a dull sheen. A number of different color varieties (some of which occur regionally) are known, but no subspecies are recognized. The dorsum ranges from yellow to yellowish, reddish, dark brown to black. The better known color varieties (of which intermediates may occur) are: a) Yellow Cobra--yellow above uniform or often speckled with light and dark brown, eye reddish brown--widely distributed, and the only variety found in Botswana; b) Brown or Speckled Cobra--bright shiny reddish to dark mohogany above, uniform or with darker and paler markings--southwestern Cape Province; etc. c) Black Cobra - shiny purplish black above and below--northwest Cape and Great Namaqualand. A dark throat band (up to 17 ventrals wide) is distinct in juveniles, but may be indistinct or absent in adults.

Distribution:

A Cape endemic, ranging throughout the Cape Province, and extending into the neighboring regions of the Orange Free State, Lesotho, southwestern Transvaal, Botswana, and South West Africa.

Biology:

The most dangerous of African cobras,due to the high toxicity of its venom, and the frequency with which it is found around human habitation. An active, nocturnal snake, it is often attracted to farm-houses and stock-pens in search of rodents, that form an important part of its diet. Lizards, amphibians and other snakes are also readily taken. Oviparous, from 8-20 eggs (60 X 30mm) are laid in mid-summer (December--January) in an underground hole, or other suitable location. They are found in a wide variety of habitats, including the riverline valleys of the soutehrn Cape Province and the mountain slopes (up to 2,400 metres) of western Lesotho. They are particularly common in the dry savanna of the Karoo. Spreading a broad hood when disturbed, it is more nervous than most other cobras and will strike readily. During the mating season (September to October) it has even been observed to advance on intruders. The venom is highly neurotoxic, and the most potent of African cobras. 120 mg is an average venom yield, although large snakes may exceed 250 mg. Only slightly less toxic than black mamba venom, from 15-20 mg may be a lethal dose in adult humans.

Naja mossambica Peters

Mozambique spitting cobra Fig. 19.

Identification:

A small cobra, adults averaging a metre in length and rarely exceeding 1.5 metres. The blunt head is barely distinct from the neck, whilst the moderate-sized eye has a round pupil. There are 6 upper labials (occasionally 7 or 8), the 3rd entering the orbit, and 9 lower labials. On average females have slightly higher ventral counts (188-207) than males (180-196), but there is no sexual dimorphism in the paired subcaudals (females, 55-68; males, 53-71). The anal is entire. Mid-body scale rows usually 23, but may range from 21-27, the scales being smooth with a satiny texture on the back, but shiny below. The dorsal coloration varies from pale grey to dark olive, with each scale edged in black; the ventrum ranges from salmon pink to yelowish, with a series of irregular black crossbands and blotches on the throat--never a single broad dark band.

Distribution:

Distributed in south-eastern Africa from southern Tanzania to Natal, and west through the Transvaal, Botswana and north-eastern South West Africa to Maconjo in southern Angola. It inhabits savanna from sea-level to 1,500 metres. Replaced in north-eastern Africa by the species pallida.

Biology:

Perhaps the commonest cobra of the low-veld regions of the Transvaal and Zimbabwe, Basically nocturnal (although often found basking during the day), it emerges at dusk from its hiding place among rock crevices, hollow logs, termitaria, etc., to forage for food. Catholic in its tastes, small mammals, birds, lizards, snakes, even grasshoppers are eaten. However, like the Rinkals and Egyptian cobra, it preys heavily on toads. Oviparous, from 10-20 eggs (35mm X 20mm) are laid in mid-summer.

In common with Naja nigricollis and Hemachatus haemachatus it has the ability to accurately spit venom two to three metres into the face of an intruder. Amazingly large amounts of venom are produced, and may be quickly replaced. On entering the eyes it produces an immediate acute burning sensation, the conjuctiva quickly becoming oedamatous and inflamed. Ulceration of the cornea, leading to blindness may follow in untreated cases. If spitting does not deter an intruder, like the Rinkals it may sham death. Bites are relatively rare (although in some regions they may be among the commonest cobra bites), and the venom of low toxicity and lacking major neurotoxic effects.

Naja nigricollis nigricollis Reinhardt

Black-necked Spitting-cobra

Identification:

The largest spitting cobra, adults may exceptionally reach 2.8 metre in length. The broad head has a rounded snout, and is hardly distinct from the neck. The eye is of moderate size with a rounded pupil. The ventral and subcaudal counts of southern populations range from 182-196 and 54-66, respectively, with little indication of sexual dimorphism. Mid-body scale rows range from 17-21 (usually 19 in Western Zambia, and 21 in southern Angola), but are higher in West Africa. The dorsum ranges in coloration from dark olive-brown, slate-grey or black, whilst the ventrum ranges from yellow to red with a broad dark band on the throat and usually dark infuscations or uniform blackish posteriorly. Juveniles are usually lighter in color than adults.

Distribution:

Basically extra-limital to the area under discussion, it ranges from Senegal east to Kenya and south to Western Zambia, Tanzania, and southern Angola, being recorded in soutehrn Africa only from a single female collected at Katima Mulilo in the eastern Caprivi.

Biology:

Unlike the two southern races, woodi and nigricincta, which inhabit noticeably arid regions, typical nigricollis is largely confined to the relatively moist savannas which border the equatorial forests. Basically nocturnal (although juveniles are more diurnal) it is similar in much of its behavior, diet, reproduction,etc., to mossambica. It may, however, be slightly more aquatic. Its venom is produced in large amounts (yields averaging 200-350 mg) but is relatively less toxic (40-50mg being an average lethal dose in humans) than other cobra venoms, except mossambica. Again like mossambica the venom is usually spat into the eyes of an intruder, and in the few bites recorded neurological symptoms have been noticeably lacking, local pain, swelling and necrosis predominating. Haematological abnormalities and complement depletion have also been noted following nigricollis envenomation.

Naja nigricollis woodi Pringle

Western Black Spitting-Cobra

Identification:

A medium-sized cobra, adults averaging 1.2 - 1.5 metres in length, and exceptionally reaching 1.8 metres. Head scalation is similar to typical nigricollis, from which it is readily distinguished by the higher ventral counts (221-228; intergrades with neighboring nigricincta may have ventral counts as low as 216) and black coloration. Mid-body scales are consistently in 21 rows, whilst the paired subcaudals range from 65-78, and like the ventrals show little evidence of sexual dimorphism. Adults are usually uniform black above and on the chin and throat, the rest of the ventrum being dark grey streaked with black. Juveniles between 550-700mm in total length are grey with the head and neck black. Specimens from the Kuiseb River in central South West Africa may show faint banding, indicative of intergradation with nigricincta.

Distribution:

Inhabiting the semi-desert regions of southern South West Africa, extending from the Kuiseb River south through Great Namaqualand to Citrusdal in the Cape Province.

Biology:

Very little is known about this rare snake, which for some time was confused with the black variety of Cape cobra.

Naja nigricollis nigricincta Bogert

Western Barred Spitting-Cobra Fig. 20.

Identification:

A small spitting-cobra, adults averaging 1.2 metres and rarely exceeding 1.5 metres in total length. Head scalation is similar to typical *nigricollis*, from which it is immediately recognizable by virtue of its striking banded pattern. Mid-body scale rows usually number 21 (occasionally 22 or 23), whilst the ranges of the ventrals (males, 192-218; females 196-226) and paired subcaudals (males, 59-73; females, 57-71) are intermediate between neighboring *woodi* and typical *nigricollis*. In adults the ground color of the dorsum ranges from light greyish brown to pinkish or reddish brown, with 51-86 black bands on the body and 13-32 bands on the tail. The bands are generally irregular and subequal in width (although occasional specimens have much narrower black bands), and much more intense in juveniles, tending to become less clearly-defined in adults. The black bands extend across the ventrum (sometimes in paler form), the ground color of which ranges from yellowish white to light reddish brown. A broad (up to 17 ventrals) black band, that is particularly striking in juveniles, extends across the throat.

Distribution:

Inhabiting the dry savanna and semi-desert regions of Central and northern South West Africa and south-western Angola.

Biology:

Presumably similar in its behavior and diet to typical *nigricollis*, very little is known about the habits of this attractive cobra. Due to its ability to spit and its strongly banded pattern, it was for some time confused with the Rinkals.

HYDROPHIDAE

As discussed in the introduction to this chapter the content and relationships of the Hydrophidae has been the subject of much recent debate. As currently defined by McDowell (Smith et al., 1977) it includes all true sea snakes (sensu Smith, 1926) (excluding the sea kraits of the genus

Laticauda) and the terrestial elapids of Australasia. The pros and cons of this rearrangement need not concern us, as southern Africa is peripheral to the main distribution of sea snakes, with only a single, possibly vagrant representative, Pelamis platurus.

SYSTEMATIC ACCOUNT

Family : Hydrophidae
Subfamily: Hydrophinae
Tribe: Hydrophiini

Pelamis platurus (Linnaeus)

Yellow-bellied Sea Snake

Identification:
The only marine snake found in southern African coastal waters, it is instantly recongizable by virtue of its bright yellow and black coloration, and laterally-compressed, oar-like tail. Adults average 600-750mm in length, although females may exceptionally reach a metre. The head is narrow, flattened, hardly distinct from the neck, and has an elongate snout. As with elapids there is no loreal, the 2nd upper labial contacting the prefrontal. There are 7 to 8 upper labials, the 4th and 5th entering the orbit when not excluded from it by 1 or 2 suboculars, and 10 or 11 lower labials. The body is strongly compressed, especially posteriorly, and covered in small polygonal scales, that are usually smooth, except in males in which the scales of the outermost rows on either side each bear two or three small tubercules. There are 49-67 scale rows around athe thickest part of the body. The ventrals total 264-406, and are small, usually divided, and scarcely wider than the adjacent body scales. There is no enlarged anal plate, rather a moderately enlarged preanal scale. Coloration is extremely variable with up to 7 recognized variants, and many intermediate conditions. Basically the color pattern consists of a black or dark brown dorsum, that contrasts with a cream, yellow or pale brown ventrum, the colors being sharply disjunct along a mid-lateal line. The tail is yellowish, with varying degrees of black spots or bars. All yellow and all black variants are known from eastern pacific waters.

Distribution:
The only truely pelagic sea snake, it has an immense range in the tropical and warm-temperate waters of the Indo-Pacific region. Due to its pelagic nature it is subject to waif dispersal and has been recorded from a wide variety

of localities, including the east coast of Africa as far south as Cape Town, New Zealand, and the eastern Pacific.

Biology:

In recent years there have been a number of ecological (Kropach, 1971, 1975), physiological (Graham, 1971, 1974; Seymour, 1974; Dunson, et al., 1971) and zoogeographical (Dunson and Ehlert, 1971) studies on Pelamis, particularly on specimens from the Gulf of Panama. Data for Southern African specimens (Vissor, 1967; Van Bruggen, 1961) is sparse, but does not conflict with that of Panamanian snakes. In the following account it is assumed that the biology of Pelamis throughout its extensive range is basically the same, and thus applicable to southern African snakes.

Pelamis swims using lateral undulations similar to that used in locomotion by terrestial snakes. However, due to its laterally compressed body, and reduced ventrals, it is helpless washed ashore. Usually observed swimming slowly or lying motionless at the surface, it can sustain short rapid bursts of swimming, either backwards or forwards. Subject to the vagries of surface currents, Pelamis is often found in association with sea-slicks--smooth, narrow, long lines on the ocean surface, where surface currents converge and floating vegetation and debris accumulate. Associated with these slicks are numerous small fishes on which Pelamis exclusively feeds. Lying in ambush at the surface, often partly hidden in the floating vegetation, it may stalk individual fish, seizing them with a sudden lunge, or when a shoal of fish approaches swim frenziedly among them indiscriminately biting anything in its path.

Few large marine predators (fish or porpoises) prey on Pelamis, and many potential predators on Pelamis in the Gulf of Panama were observed to actively avoid these snakes. When Atlantic predatory fish (who would not normally encounter Pelamis) were tested, they readily attacked and ate Pelamis (Rubinoff and Kropach, 1970). However, 1 in 12 of these fish were bitten and died following feeding, leading these authors to suggest that the unique yellow and black coloration of Pelamis may be aposematic. In an unusual record van Bruggen (1961) observed a captive Pelamis (washed ashore near Port Elizabeth, South Africa) consumed by an Octopus. However, similar examples of such predation in the wild must be very unlikely in view of the different habitats occupied by the two species.

Like other sea snakes (excluding the sea kraits Laticauda) Pelamis is viviparous, giving birth at sea to 3-8 young, approximately 250mm inlength. Pregnant females have been collected off the South African Coast from March to October (Visser, 1967), with little indication that reproduction is

seasonal. However, a high percentage of specimens collected from the Pacific coast of Costa Rica in the dry season (December to April) are gravid females (Bolanos et al., 1974), suggesting seasonal reproduction.

Little is known of the venom of Pelamis. Bolanos et al. (1974) obtained venom yields of 0.87 mg crystallized venom from adult snakes from Costa Rica. The maximum yield obtained was 4.4 mg from a 750 mg snake. At least 10 mg dry venom were required to kill a 60 kg sheep, and it was concluded improbable that even a full-grown sea snake could kill an adult human. However, F. FitzSimons (1919) records a number of fatalities following bites by Pelamis washed ashore on the South African coast, although giving few details of the symptoms of envenomation. Whether the venom of South African Pelamis is more toxic than Costa Rican sea snakes is not known.

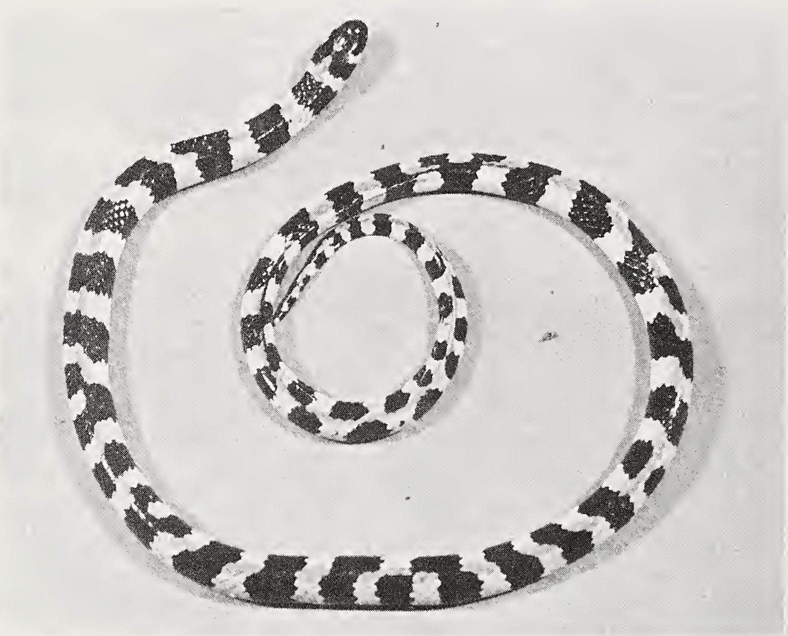

Fig. 1. A dwarf garter snake, Homoroselaps (Elaps) lacteus, from the Eastern Cape Province. These small brightly colored semi-fossorial snakes have recently been removed from the Elapidae, and are believed to be related to Aparallactine colubrids. Photograph by the author.

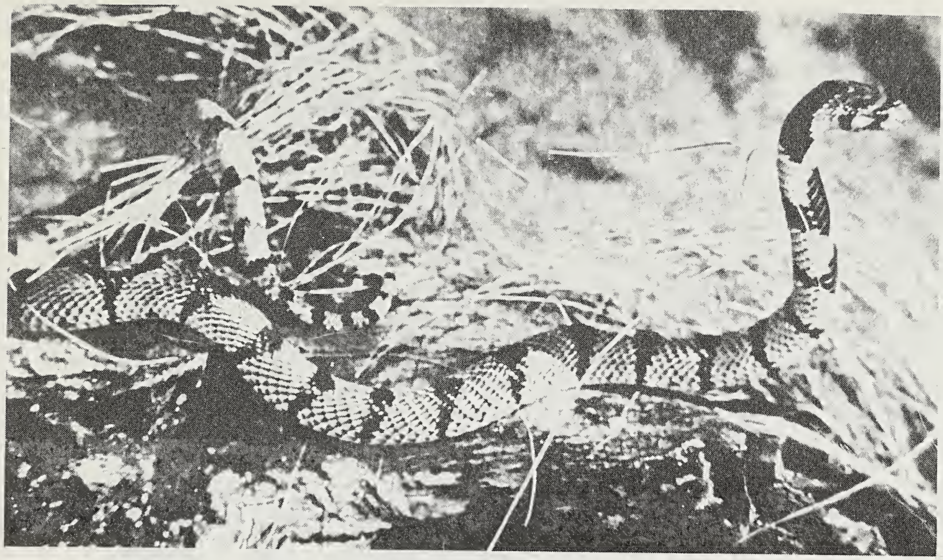

Fig. 2. The southern Coral snake, Aspidelaps lubricus lubricus, in its typical threat posture.
Photograph by A. Bannister

Fig. 3. A large western Coral snake, Aspidelaps lubricus infuscatus, spreading a narrow hood.
Photograph by the author.

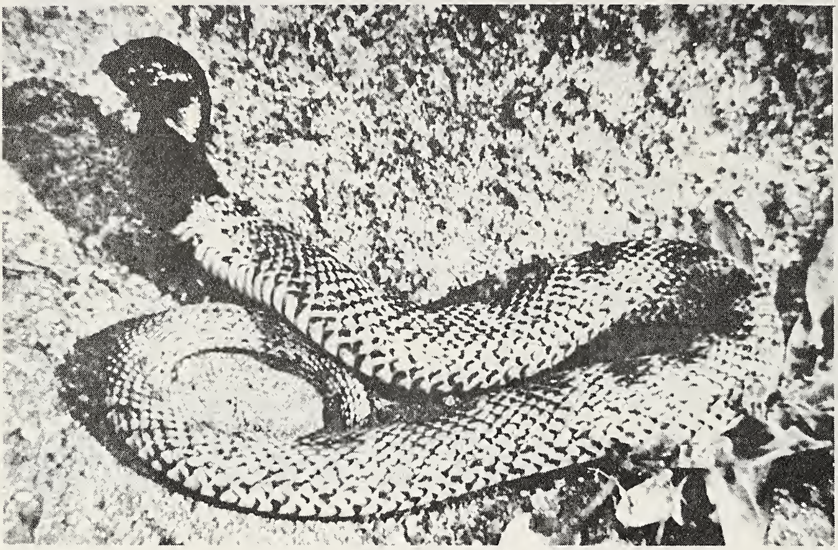

Fig. 4. An adult shield-nose snake, Aspidelaps scutatus scutatus, from Vivo in the Northern Transvaal, South Africa. Photograph by A. Bannister.

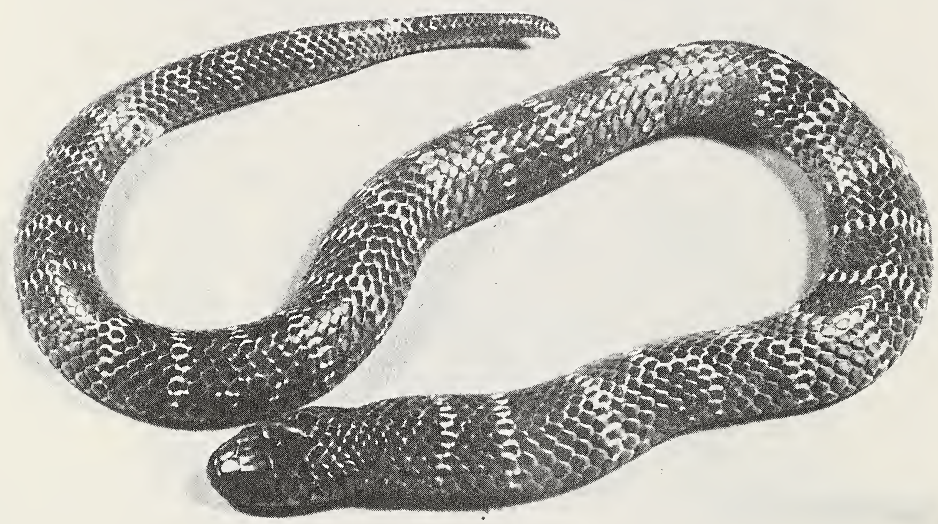

Fig. 5. A juvenile Gunther's garter snake, Elapsoidea guentheri, from Chibi, Zimbabwe.
Photograph by D.G. Broadley.

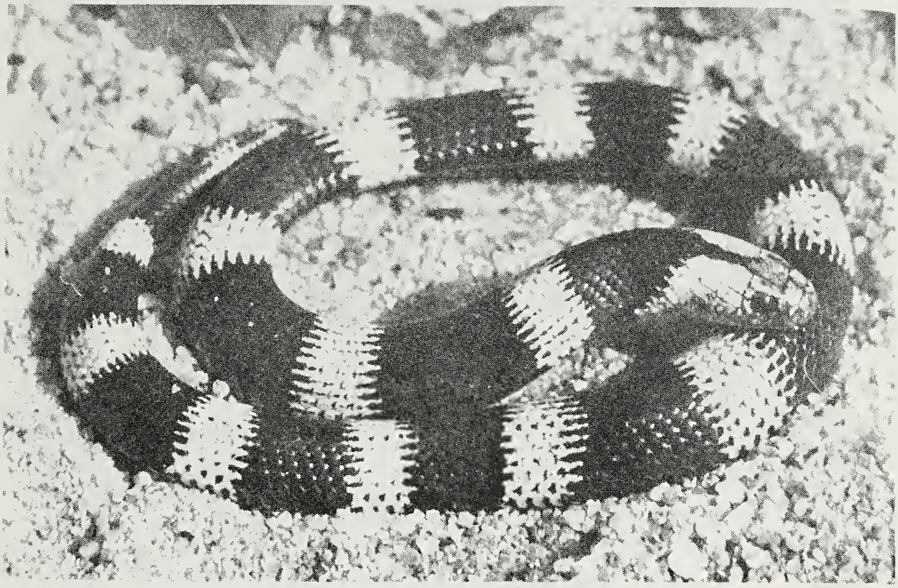

Fig. 6. A juvenile Boulenger's garter snake, Elapsoidea semiannulata boulengeri, showing the typical black and white banded pattern of young snakes.
Photograph by the author.

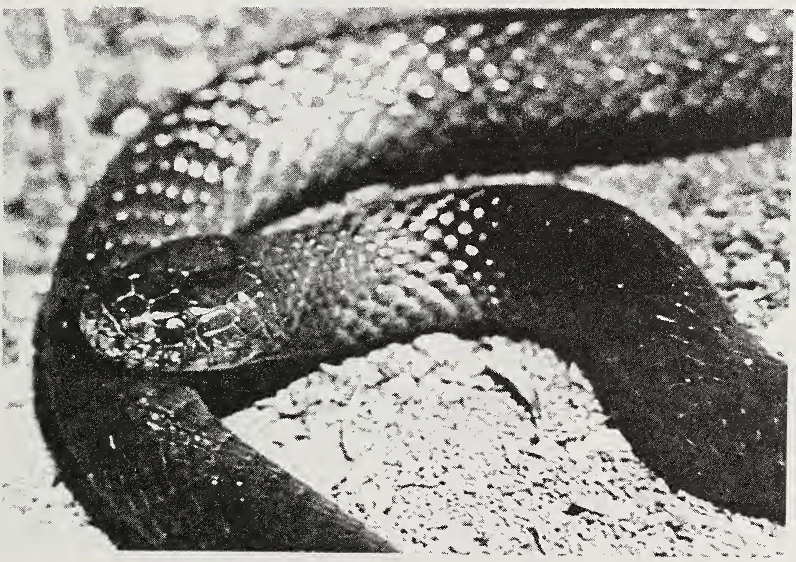

Fig. 7. A large Boulenger's garter snake, Elapsoidea semiannulata boulengeri showing the uniform gun metal coloration of adults.
Photograph by the author.

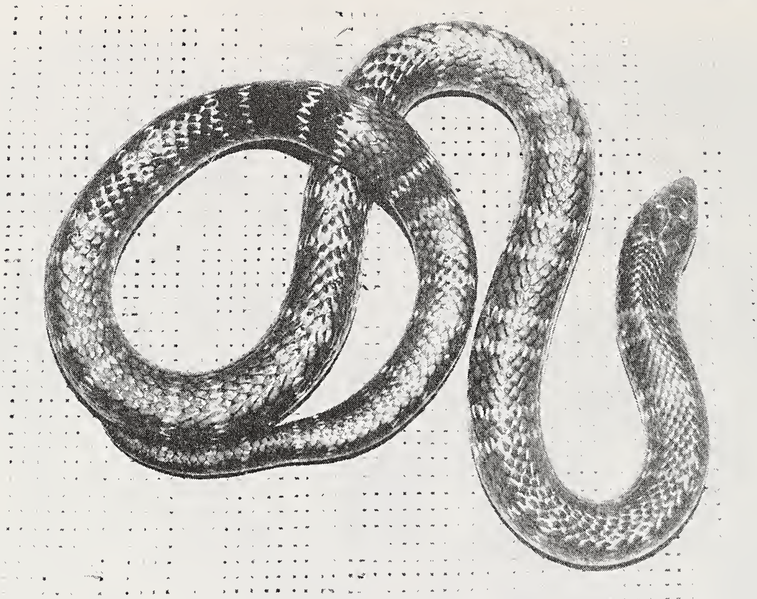

Fig. 8. A large Sundevall's garter snake, Elapsoidea sundevalli sundevalli, showing the faint paired light bands that are retained in adults of this race.
Photograph by the author.

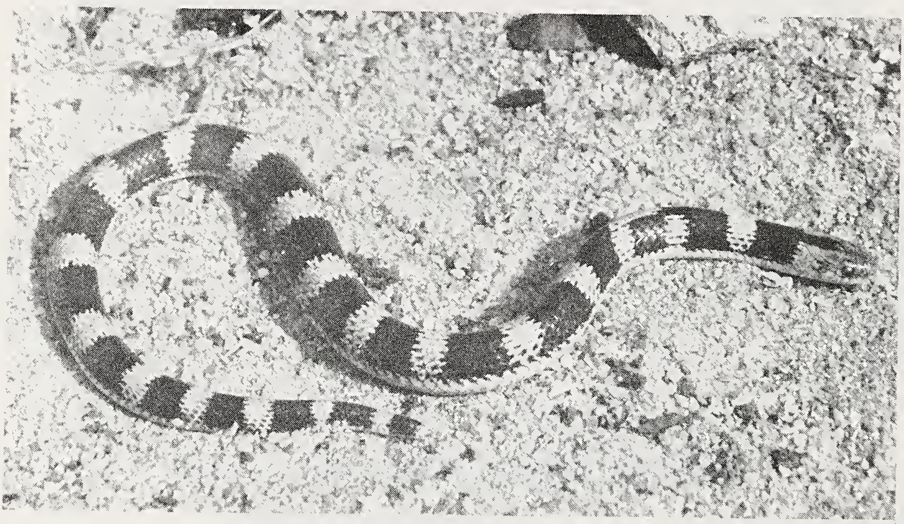

Fig. 9. A juvenile High veld garter snake, Elapsoidea sundevalli media.
Photograph by the author.

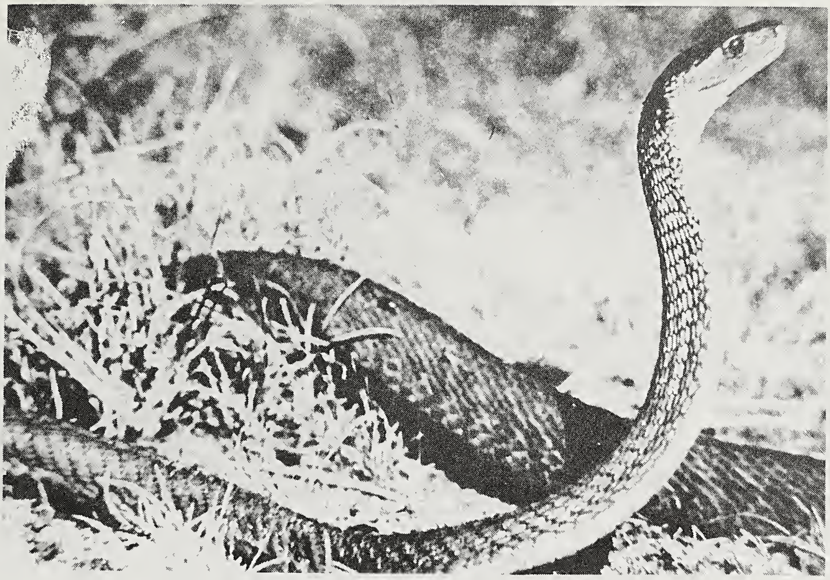

Fig. 10. A large black mamba, Dendroaspis polylepis, from the northern Transvaal, South Africa.
Photograph by A. Bannister.

Fig. 11. The head of a large black mamba, Dendroaspis polylepis, showing the large fangs (and replacement fangs), dark lining to the mouth, and the extensive maxillo-prefrontal articulation.
Photograph by the author.

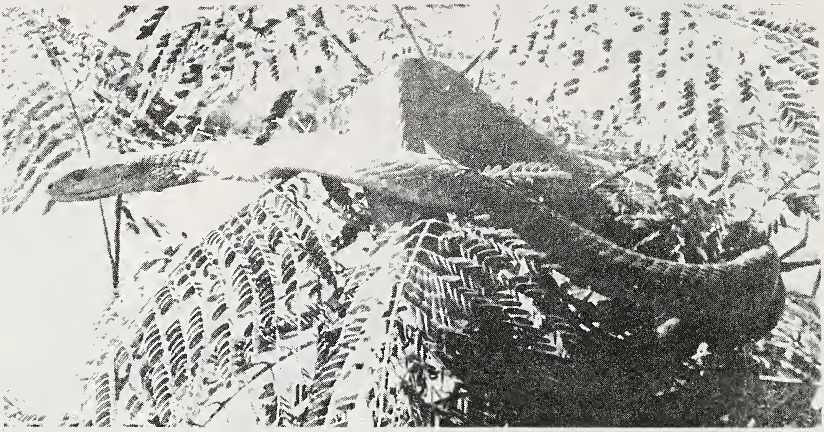

Fig. 12. A green mamba, Dendroaspis angusticeps, from Malawi.
Photograph by D.G. Broadley.

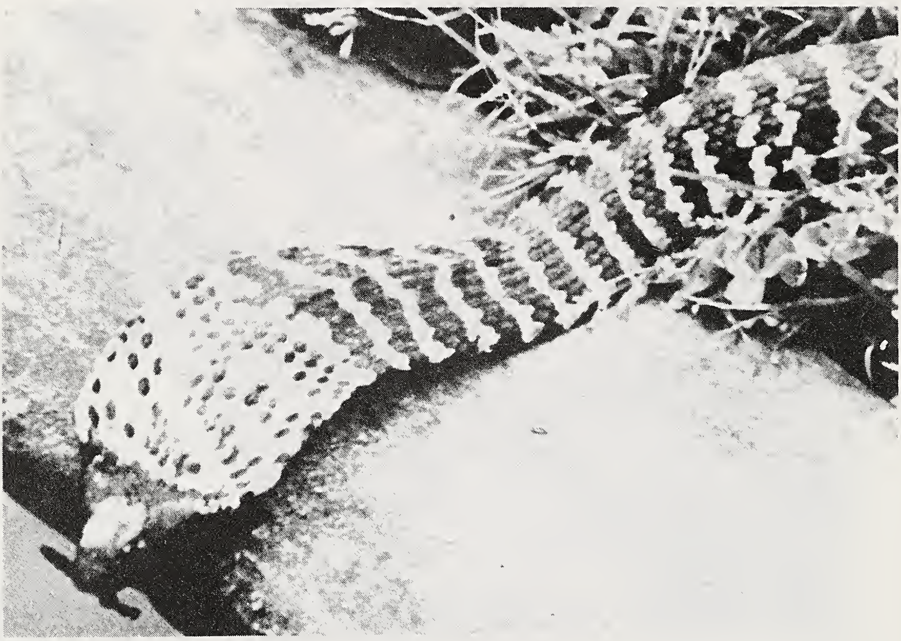

Fig. 13. A strikingly banded young ringhals, Hemachatus haemachatus, from the eastern Cape Province.
Photograph by the author.

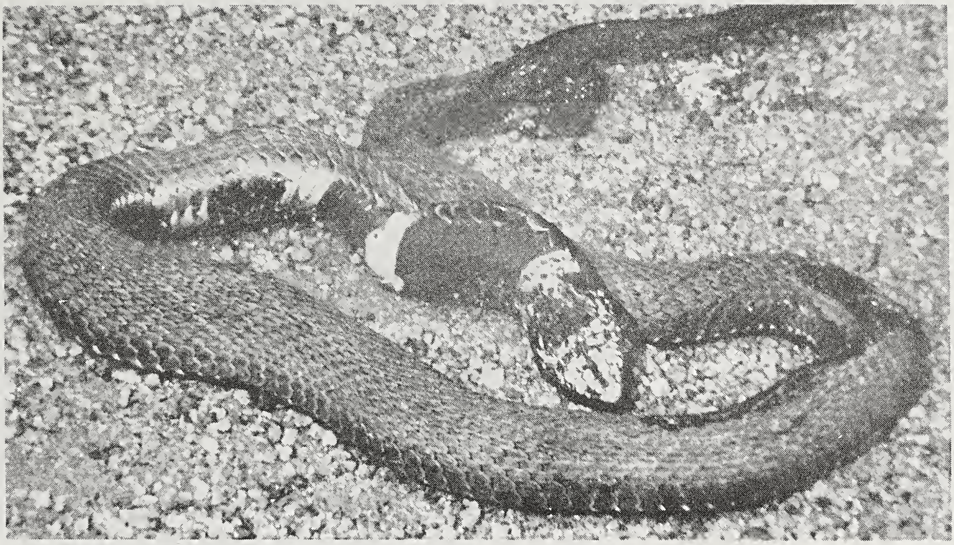

Fig. 14. A ringhals, Hemachaus haemachatus, shamming death.
Photograph by W. Haacke.

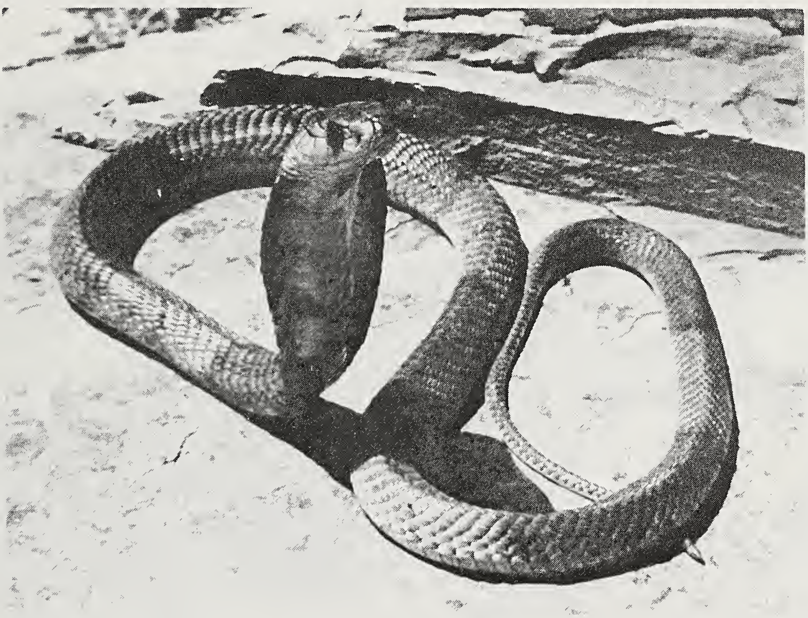

Fig. 15. A young Egyptian cobra, Naja haje annulifera, from the Transvaal, South Africa, showing the faint wide bands that frequently occur in this race.
Photograph by the author.

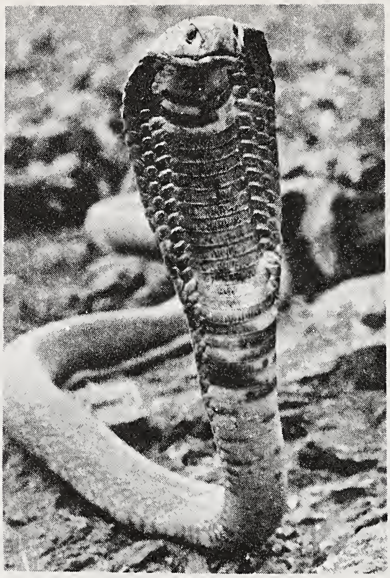

Fig. 16. An unbanded Egyptian cobra, Naja haje annulifera, in typical threat posture.
Photograph by the author.

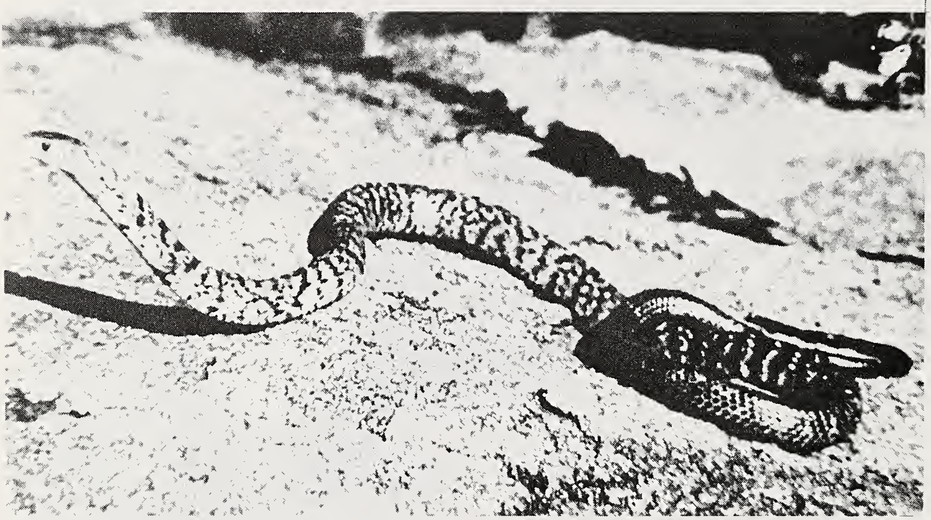

Fig. 17. A large forest cobra, Naja melanoleuca, from the Dukuduku forest, Natal, showing the typical coloration and glossy scales.
Photograph by A. Bannister.

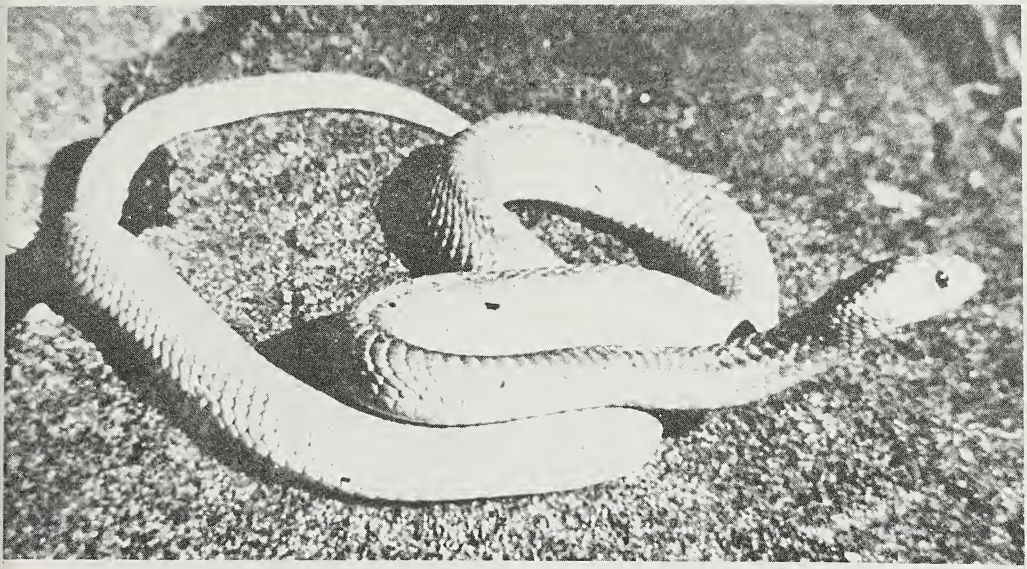

Fig. 18. A large, yellow Cape cobra, Naja nivea.
Photograph by A. Bannister.

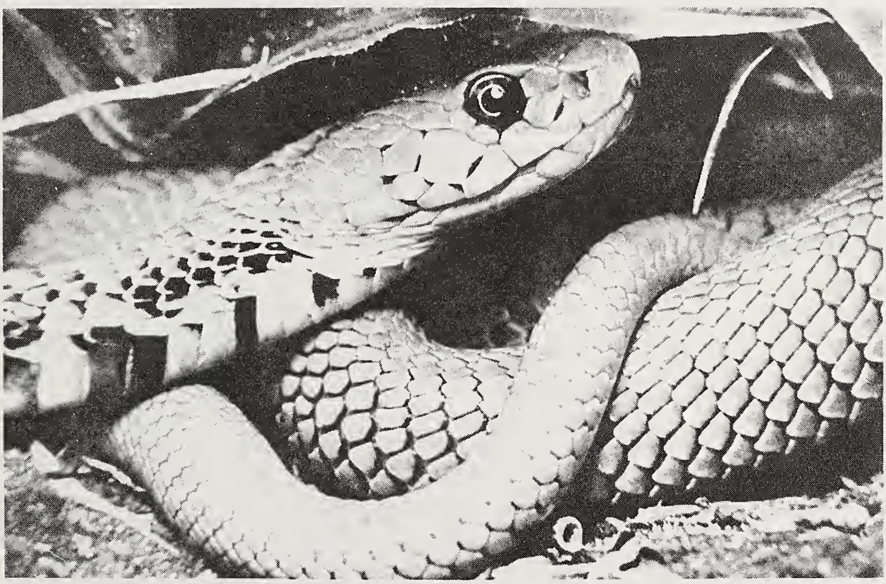

Fig. 19. A young Mozambique spitting cobra, Naja mossambica.
Photograph by A. Bannister.

Fig. 20. A western barred spitting cobra. Naja nigricollis nigricincta, showing the narrowly banded pattern. Photograph by W. Haacke.

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THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

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Volume 17 Number 2 June 1981

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 17 | 30 JUNE 1981 | NUMBER 2

ANOTHER EPIPHYTIC ALLIGATOR LIZARD (*ABRONIA*) FROM MEXICO

Hobart M. Smith and Rozella B. Smith

Abstract

Abronia chiszari is described from rainforests of the Sierra de Tuxtla, 2.5 mi E Cuetzalapan, Veracruz. It is a member of the *deppei* group and closely similar to *bogerti*, a species of the cloud forests of the Pacific slopes of southern Oaxaca.

A survey of non-iguanid lizards from Mexico in U.S. museums, preparatory for a review in the series summarizing present knowledge of the herpetofauna of Mexico (e.g., Smith and Smith, 1980), has revealed a hitherto unreported species of *Abronia* from the rainforests of the Sierra de Tuxtlas near Laguna de Catemaco of southern Veracruz, whence no other anguid has been taken. We here name it

Abronia chiszari sp. nov.

Holotype. University of Texas at Arlington, Collection of Vertebrates, R-3195, an immature male from 2.5 mi E Cuetzalapan, 18 Aug. 1962, William F. Pyburn. No other specimens known.

Diagnosis-Definition. Very similar and presumably related to *Abronia bogerti*, having 41 transverse rows of dorsals between occipital and base of tail, more than a minimum of six scales in a transverse row of nuchals, parietals broadly contacting supraocular 3 and 4, supranasals unexpanded, one temporal reaching oculars, two temporals

contacting supralabials, one postsubocular supralabial, 11 dark crossbars from occiput to base of tail (as in *reidi* and the *aurita* group); differing from *bogerti* in having cantholoreal separated from frontonasal by contact of prefrontal and canthal, 3-3 anterior temporals, two anterior internasals, an azygous internasal between anterior and posterior pairs, superciliaries narrowly contacting or narrowly separated from prefrontal, anterior supraocular narrowly contacting or narrowly separated from cantholoreal, minimum number of nape scales in a transverse row seven.

Description of holotype. In addition to character-states mentioned in the diagnosis-definition, supranasal not enlarged on one side, slightly on other, the two widely separated; posterior internasals widely separated, left twice size of right, an asymmetrical azygous internasal between, contacting both supranasal and frontonasal; latter larger than either prefrontal, bounded on each side by a canthal; prefrontals broadly in contact; supraoculars 5-3 on each side; two superimposed, contiguous postnasals; one loreal; one cantholoreal; superciliaries in a complete series, broadly contacting cantholoreal and preocular; a large subocular, anterior tip split off as a separate scale on one side; two postoculars, lower broadly contacting subocular; three anterior temporals, upper two small, lowermost enlarged, not contacting subocular; 3-3 secondary, 4-4 tertiary temporals; frontal broadly contacting interparietal; frontoparietals small; one large occipital, larger than interparietal; 9-9 supralabials; 8-8 infralabials; one contiguous pair of chinshields, followed by three split pairs, only one scale separating members of first.

Paravertebral scales in one transverse nape row fused, partially fused in two other rows, producing a minimum of seven scales in those rows; all other transverse rows on nape with eight or more scales; dorsals in 16, ventrals in 12 longitudinal rows at midbody; 56 ventrals between postmental and anus; five preanals bordering anus; tail incomplete, 32 whorls on remaining base. Osteoderms not discernible due to immaturity, but presumably absent posterior to nape, as in *bogerti*.

Measurements in mm: s-v 40.5; incomplete tail, 24; maximum head width, 6.5; foreleg 10; axilla-groin, 23; hind leg, 11.5.

Each dark crossbar, dark tan in color, three scales long, dark-edged posteriorly, separated from adjacent bars by a paler brown space 1½ scales long; head dark tan above; venter very pale brown, unmarked but with tiny dark dots.

Comparisons. A remarkable resemblance of *chiszari* and *bogerti* exists - so great that if the specimens now known (one of each) had been taken from localities of shared habitat and physiography, we would assume with confidence that they represent one species. In reality, there is an extensive physiographic and habitat discontinuity between the localities represented - *bogerti* from the upland cloud forests on Pacific slopes of extreme southeastern Oaxaca, some 75 km from the coast, *chiszari* from the lowland rainforests of the Sierra de Tuxtlas of southern Veracruz, of strictly Atlantic drainage and some 15 km from the Gulf of Mexico. Between these two localities lies a vast expanse of lowland savanna totally uninhabitable by *Abronia*, so far as is now recorded for the 14 known taxa. It is unlikely that even all of the intervening uplands are hospitable to the genus. Indeed, on the basis of geographic proximity, the present specimen should represent *reidi*, the species recorded for Volcán San Martín Tuxtla, only some 20 km away. On the contrary *chiszari* is widely different from *reidi*, which has 36-37 dorsals, a minimum of six scales in a transverse nuchal row, three temporals contacting orbital scales, lower temporal contacting subocular, two postsubocular supralabials, supranasals in contact medially, no canthal, etc. (in *chiszari*, respectively, 41 dorsals, seven in a nuchal row, one temporal to orbit and not contacting subocular, one postsubocular labial, supranasals separated and not enlarged, an anterior canthal).

The similarities of *chiszari* to *bogerti* extend to some of the most distinctive features of the latter species: the greatest number of dorsals (41 in each), and the greatest minimum number of scales in a transverse row of nuchals (seven and eight, respectively) known in the genus. No other species has more than 39 dorsals, so far as recorded at present, and no other has more than six as the minimum transverse nuchal count. It is uncertain whether *chiszari* matches *bogerti* in its greatest number (105) of caudal whorls known in the genus, since part of the tail is missing. Other similarities are noted in the preceding diagnosis-definition.

Nevertheless a number of distinct differences between *chiszari* and *bogerti* exist; how many will prove to be constant in larger series remains to be established, but at least some of them are of a nature that has been shown to be reliable in distinction of other species. The most likely to be constant are (1) separation of cantholoreal from frontonasal by contact of prefrontal and canthal, and (2) three primary temporals, the upper two very small, in *chiszari* (cantholoreal contacting frontonasal, and two primary temporals, the upper one very small, in *bogerti)*. Less likely to be constant are differences in the internasal area (two anterior internasals and an azygous median internasal in *chiszari;* four anterior internasals and no azygous internasal in *bogerti*) and the nuchal region (seven minimal transverse count in *chiszari,* eight in *bogerti*). Probably eight is the normal minimal transverse nuchal count in both taxa. What differences may exist, if any, in adult coloration, osteoderm development and number of caudal whorls is unknown. The brownish, cross-barred adult pattern of *bogerti* is assured, but *chiszari* could be green in adults since the young of the green species of the genus are cross-barred, and other closely related pairs of taxa are known to differ in this respect (*e.g.*, *taeniata* and *fuscolabialis* from *graminea, lythrochila* from *ochoterenai, oaxacae* from *mixteca* - the green taxon cited last for each pair).

Habitat. The most amazing revelation of *chiszari* is documentation of occurrence of the genus not only in high-altitude cloud forests characterized by abundant bromeliads, as first noted by Bogert and Porter (1967: 15-16), but also in similarly humid and bromeliad-infested, moderately low-altitude rainforests. *Abronia chiszari* is the only member of the genus known to exist in the latter habitat. The notes taken by the collector, Dr. Pyburn, and kindly transmitted by Mr. Karges, reveal that the holotype was actually captured by a companion's (Dr. Robert F. Anderle) son on the bumper of Dr. Pyburn's car as it was parked by a trail through a typical rainforest of tall, buttressed trees and abundant lianas, at an elevation no more than a few meters above that of Laguna de Catemaco at 360 m above sea level. Rainfall can exceed 4000 mm/yr (Anderle, 1967: 164) and has been recorded at 5248 mm in Coyame (Edwards and Tashian, 1959: 326), which like the type locality is on the east side of Laguna de Catemaco.

It is our opinion, however, that the existence of *chiszari* in a moderately low-altitude rainforest (bastonal) is not necessarily indicative of possible occurrence of *Abronia* in all lowland rainforests of southeastern Mexico, but is a product strictly of the moderate altitude and the continuity of that particular segment of rainforest with the upland cloud forests of the Sierra de Tuxtla. The whole uplift, including Laguna de Catemaco, is completely surrounded by lowlands of less than 100 m altitude, very expansive in all directions except toward the coast, where the uplift is but a few kilometers from the shores of the Gulf of Mexico. The seasonal extremes of wet and dry seasons are accentuated at lower altitudes, less evident in the Sierra de Tuxtla. It is highly likely that *chiszari* does not range beyond the Sierra.

It does appear, however, that even within the Sierra de Tuxtla there is a segregation of *Abronia* species. *A. reidi* is known only from the crater rim of Volcan San Martin Tuxtla, at 1550 m. Whether it ranges to altitudes as low as that of *chiszari* is unknown, and whether the latter species ranges to the crest of the nearby Cerro Campanario (1180 m), Cerro Cintepec (890 m), Volcán San Martín Pajapan (1145 m) remains to be determined. Each peak could possibly harbor a distinct species, since *reidi* and *chiszari* successfully exist in such close proximity in isolated and distinctive, although narrowly limited, habitats.

In tall forests *Abronia* appears very likely to be a canopy inhabitant; the holotype of *chiszari* undoubtedly fell from heights far above the ground, and Alvarez del Toro (Smith and Alvarez del Toro, 1963: 103) reports a specimen of another species (*lythrochila*) dropping to the ground at his feet from a tree whose lowest limbs were "some 40 meters from the ground." He also reported observing many specimens with binoculars at inaccessible heights in tall trees.

It is thus not surprising that several species of *Abronia* are extremely rare; special effort is required to detect and capture at least those that live in the high canopy of rainforests. Undoubtedly species other than those now known exist, and knowledge of range of even the latter is woefully deficient. Unfortunately, all such species are so severely threatened by rapid rainforest destruction that their present distribution and even their existence may never be known.

Useful maps and habitat photographs of the Sierra de Tuxtla region, including a figure of the type locality, appear in Anderle (1967: 169, fig. 5).

This species adds another to the growing list of endemics of the Sierra de Tuxtla, and strengthens the justification for recognition of it as a biotic district, as proposed by Firschein and Smith (1956), although certainly not all supposed endemics will prove to be as distributionally limited as assumed (*e.g.*, *Hyla valancifer*, formerly thought to be limited to the Sierra de Tuxtla, is now recorded from Guatemala, *cf.* Duellman, 1978). If *chiszari* does occur beyond the limits of the Sierra de Tuxtla, the Guatemalan localities (4-5 km S. Purulhá, 1490-1760 m, Baja Verapaz) for *Hyla valancifer* would be a likely possibility. On the other hand, the two populations now referred to *valancifer* may well represent cryptically different species, for a continuity of range, or a brief or narrow separation of ranges, is highly unlikely.

Phylogeny. Tihen (1954: 6) has postulated that *bogerti* is the most generalized species of the genus, and we have suggested (in prep.) that with equal validity *matudai* of Volcán Tacaná of extreme southeastern Chiapas could be so considered. The discovery of *chiszari*, so remarkably like *bogerti*, leads to the thought that all three taxa, and *reidi*, are separate remnants of the ancestral stock of *Abronia*, with the *aurita* group radiating eastward into Central America, the *deppei* group westward into Mexico. Both *bogerti* and *chiszari* (as well as *reidi*) belong to the latter group, of which they appear to be in most respects the most primitive members, whereas *matudai* belongs to the *aurita* group, of which it in turn appears to be the most primitive. We remain convinced that *matudai* represents the nearest living approach to the ancestral stock of the genus.

Remarks. The species honors Dr. David Chiszar of the Psychology Department of the University of Colorado, Boulder; it is dedicated to him in gratitude for the privilege of his faithful support surpassing mere friendship, in recognition of his pioneer behavioral studies on rattlesnake behavior, and in admiration of his unique administrative talents and scientific productivity.

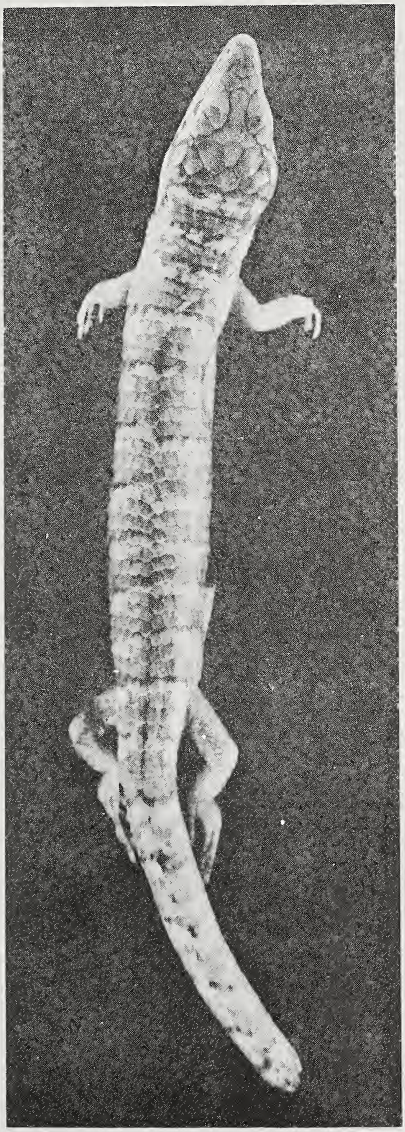

Fig. 1. Dorsal view of the holotype of *Abronia chiszari*.

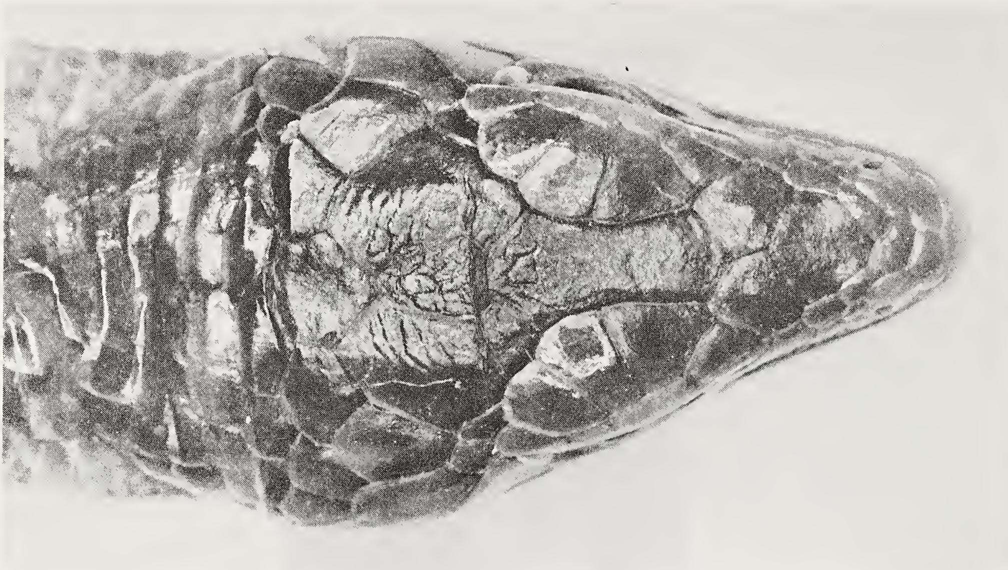

Fig. 2. Dorsal view of the head of the holotype of *Abronia chiszari*.

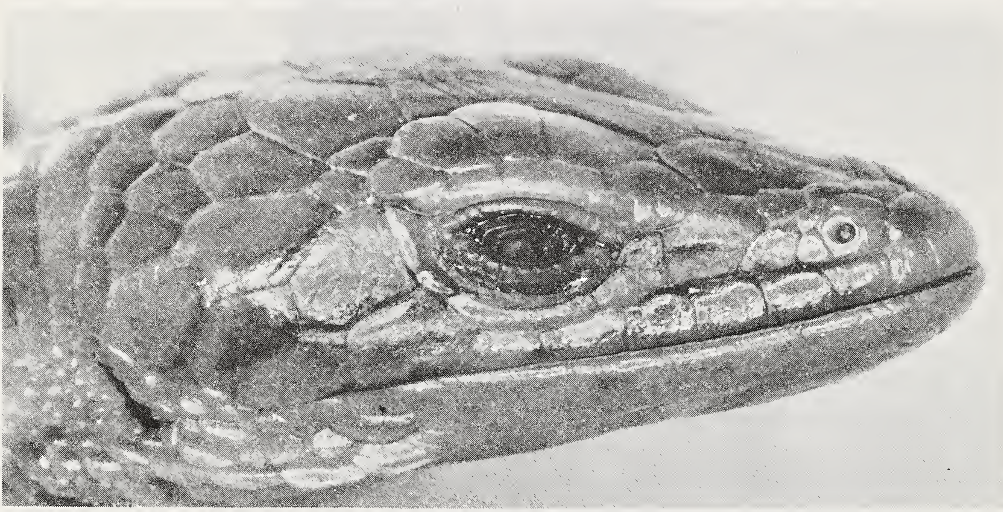

Fig. 3. Lateral view of the head of the holotype of *Abronia chiszari*.

Acknowledgments

We are greatly indebted to Dr. William F. Pyburn, collector of the holotype and Director of the museum in which it is housed, for the privilege of describing the species and for his field notes on the specimen; to John P. Karges, also of the University of Texas at Arlington, for obtaining and transmitting the field notes, preparing specimen lists and handling loans; to Mr. Richard Carter and Mr. Ralph Black of C.U.B. for photographs of the holotype; and to Dr. Alexander Cruz of C.U.B. for gracious help with the literature.

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ADDITIONS TO THE KNOWLEDGE OF THE AMPHIBIANS OF THE ESTACION DE BIOLOGIA TROPICAL "LOS TUXTLAS" (U.N.A.M.), VERACRUZ, MEXICO

In the preliminary list of reptiles and amphibians from the Estación de Biología Tropical (Pérez-Higareda, 1978), thirteen species of amphibians were recorded for the eastern zone of the Station. Faunistic surveys conducted since then have revealed the occurrence of eight additional amphibian species, here recorded on Station grounds.

Although the Los Tuxtlas region as a whole embraces different topographic levels from sea level to 1700 m, as well as diverse types of vegetation and climates (Gómez-Pompa, 1978), much less variation exists in the "Los Tuxtlas" Biological Station itself. Elevations there range only from 160 to 500 m above sea level (Lot-H, 1976), and Tropical Rain Forest is the predominant vegetation. Between the eastern and central zones secondary vegetation ("acahual") is prominent due to the perturbations originated by man.

Comparative field studies in all three station zones revealed no conspicuous difference between their herpetofaunae, essentially the same species occurring throughout, and in essentially the same habitats.

The following species bring the total known for the Station to 21, including the families Plethodontidae (3), Bufonidae (3), Leptodactylidae (4), Hylidae (6), Microhylidae (2) and Ranidae (2).

Bolitoglossa platydactyla (Gray)

This is probably the most abundant species of salamander in the forested areas with a wide distribution from San Luís Potosí to southern Veracruz and Oaxaca (Smith and Tylor, 1948). Twelve specimens were collected in May, June and July, with a mean snout-vent length of 54 mm, total length 106 mm.

Lineatriton lineolus (Cope)

Five specimens were collected in February, in humid, rotted tree trunks; their mean snout-vent length is 32.5 mm, total length 88 mm.

Leptodactylus melanonotus (Hallowell)

Two specimens were taken in October under dead leaves. They have a snout-vent length of 44 mm, tibia 15 mm, foot 30 mm, eye diameter 2 mm, tympanum 2 mm.

Hyla loquax (Gaige and Stuart)

Although widely distributed in lowlands from Central America to southern Veracruz, this species is not common at the Biological Station; only two specimens were captured, found on leaves at the edge of a stream in the eastern zone. Their mean snout-vent length is 40 mm, tibia 47.5 mm, tympanum diameter 0.57 mm, eye 2 mm, foot 20 mm.

Hyla valancifer (Firschein and Smith)

Duellman (1970) pointed out that only four specimens are known from Volcan San Martin, in the Los Tuxtlas region. Discovery of this species at the Biological Station is of considerable interest because the specimens previously recorded were found at elevations above 1200 m (a.s.l.).

One specimen was captured at night on a branch of the palm tree *Astrocharium mexicanum* during. The specimen, a juvenile, has a snout-vent length of 27 mm, tibia 18 mm, foot 15 mm, tympanum diameter 2 mm, eye 4 mm.

The habits of this species are unknown.

Gastrophryne usta (Cope)

Ten specimens were collected in February under dead leaves, in forested areas. Mean snout-vent length 21.4 mm, tibia 8.72 mm, foot 10 mm, eye diameter 0.5 mm.

Rana berlandieri (Baird)

This is the species most abundant in the altered areas where there are streams or grasslands. In lakes Zacatal, Azul and Emilia of the eastern zone, it occurs with

R. palmipes. Some specimens were collected in September, October and November, and have a mean snout-vent length of 65 mm, tibia 31.3 mm, tympanum diameter 6.2 mm.

Acknowledgments

I wish to express my appreciation to Dr. William E. Duellman of the University of Kansas for the identification of the species cited in the present work, as well as for other specimens in our herpetological collection; and to Dr. Hobart M. Smith of the University of Colorado for finalization of the manuscript.

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THE OCCURRENCE OF *PITUOPHIS MELANOLEUCUS SAYI* IN VERACRUZ (SERPENTES: COLUBRIDAE)

Pituophis melanoleucus sayi (Schlegel) is widely distributed in central and southern U.S.,ranging from Illinois, Indiana, and Wisconsin to southern Alberta, southward as far as western Texas and northeastern Mexico, inhabiting plains, desert or semiarid prairies and sand plains (Conant, 1975). Smith and Taylor (1945) reported the distribution of this subspecies (under the name *P. catenifer sayi*) in Mexico in the states of Chihuahua, Coahuila, Nuevo León and Tamaulipas. Stebbins (1966) summarized the distribution of the species as a whole as extending from New Jersey and Virginia to the Pacific Coast and from southwestern Canada to Florida and the Gulf coast, and in Mexico to central Veracruz and southern Sinaloa, sea level to above 9,000 ft. He did not specify what subspecies reaches Veracruz, and in fact, no precise record exists for the species in that state.

In December, 1977, I captured, at the locality of sand dunes known as "El Bajo del Ingeniero," one specimen of *P. m. sayi*. This point is located at approximately 5 km south of the city of Veracruz, between Veracruz and Mocambo beach (specimen number 173 deposited in the herpetological collection of Estacion de Biologia Tropical "Los Tuxtlas"). A year later I collected another specimen of this subspecies in the same region (15 km N of Veracruz), in the vicinity of San Julian. Scale counts as well as coloration of these specimens agree completely with those of *P. melanoleucus sayi*. In addition, still another specimen from the same region exists in the Museum of Natural History of the University of Kansas, taken at Boca del Rio, 13 km S of Port of Veracruz (KU 39703).

These three records span approximately 20 km (Fig.1). This highly restricted, isolated distribution in central Veracruz is strongly suggestive of introduction, in any of several possible ways. *P. melanoleucus sayi* has long been popular in the pet trade (Dr. Roger Conant, pers. comm.), and examples could thereby have accidentally escaped or been negligently abandoned in this region by tourists or even by local residents. Secondly, the state of Veracruz, with its

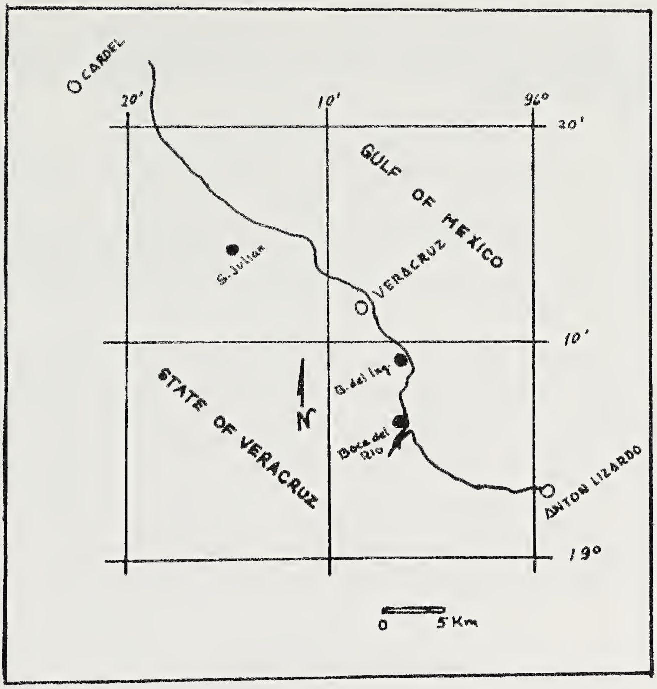

Fig. 1.

Map showing the localities of capture of *Pituophis melanoleucus sayi*.

large coastal expanse on the Gulf of Mexico, has many ports accessible to commercial ships, and for this reason the areas surrounding such ports are sometimes occupied by unusual, non-native snakes. I have captured some species which were clearly introduced this way, e.g., *Agkistrodon contortrix mokeson* in the vicinity of Alvarado and *Micrurus* sp. in a bunch of bananas in a market of Mexico City. Similarly, a *Cemophora coccinea* was collected at Catemaco by Dr. Fred S. Hendricks (pers. comm). Thirdly, it is possible that some of these exotic snakes sourced from the serpentarium that was located at Boca del Rio some years ago, working on the extraction of snake venom to make antivenin. Many snakes, both venomous and non-venomous, were no doubt shipped in to the serpentarium from far and wide, and used

not only for venom extraction but for exhibit. It is likely that some escaped, and when the establishment closed, all may have been released.

That on the other hand a natural range extension of *P. m. sayi* into central Veracruz exists seems highly unlikely in view of the tropical humid climate so very different from the usual habitat for this species. However, the capture of three specimens suggests an indeed "successful introduction" and a remarkable adaptation to a new and widely different habitat.

Nevertheless additional collecting is required to demonstrate that a self-maintaining population exists in central Veracruz, and that it is not in continuity with more northern populations in Tamaulipas. However knowledge develops in the future, for the present it is convenient to accept that, introduced or not, *P. m. sayi* is now a part of the ophidian fauna of the state of Veracruz, in some ways perhaps a parallel of the puzzling populations of *Crotalus atrox* and *Thamnophis marcianus* on the Isthmus of Tehuantepec.

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A. S. PEARSE'S DENSITY ESTIMATES FOR TURTLES: THE CORRECTION OF A LONG-STANDING ERROR

Arthur Sperry Pearse published one of the first scientific papers dealing with the population ecology of freshwater turtles (Pearse, 1923), and ever since, his paper has been cited by numerous authors in reviews and in original reports on similar topics (*see, e.g.*, Cagle, 1944; Sexton, 1959; Froese and Burghardt, 1975; and Bury, 1979). In his report, Pearse estimated the density of *Chrysemys picta* and *Chelydra serpentina* in a large bay of Lake Mendota, Wisconsin. Inasmuch as I had conducted similar population studies in New York on these same species (Petokas, 1979), it was inevitable that I would review Pearse's (1923) report and compare his density estimates with mine.

After reviewing the original literature on turtle population ecology, I pondered the *low* density estimates reported by Pearse (1923) for what appeared to be excellent turtle habitat at the Lake Mendota site. The area had been described as shallow (0.5-1.0 m) and weedy (*Myriophyllum*, *Ceratophyllum*, etc.) with a soft mud bottom (Pearse, 1923; Ream and Ream, 1966). These are all characteristics which typify habitat preferred by *C. picta* and *C. serpentina* (*see* Cagle, 1944; Sexton, 1959; and Froese, 1978); yet Pearse reported only 5.02 *C. picta* per acre (13.55/ha) and 0.7 *C. serpentina* per acre (0.19/ha) of lake-marsh habitat. I proceeded to re-estimate the size of Pearse's study site, since the area reported was much larger than that calculated by Bayless (1975) for a second, but more recent turtle study (Ream and Ream, 1966) conducted in the same bay of Lake Mendota, and it was readily discovered that Pearse has misplaced a decimal point when determining the size of his study site. Upon re-calculation from data in his paper (Pearse, 1923:24), the study area is actually 20.25 ha, rather than 202.5 ha as reported.

The corrected density estimates for Pearse's (1923) study are 135.5 *C. picta* and 1.9 *C. serpentina* per hectare of lake-marsh habitat. Ream and Ream (1966) studied *C.picta* in the same portion of Lake Mendota investigated by Pearse, but they did not estimate turtle density. However, an estimate was readily obtained by dividing their population size estimates (891 in July and 878 in August 1962; Ream and

Ream, 1966:335) by the total area of their study site (26.7 ha; as determined by Bayless, 1975:175) to yield a density of about 32.8-33.3 *C. picta* per hectare of lake-marsh habitat. This estimate is considerably less than the corrected density estimate for Pearse, suggesting that the number of *C. picta* in Lake Mendota had decreased during the 40 years between Pearse's study in 1917-1921 and the Ream and Ream study in 1962.

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NESTING AND INCUBATION TIMES IN *CORYTOPHANES HERNANDEZI* (LACERTILIA: IGUANIDAE)

The known data about the nesting and reproductive cycle of *Corytophanes hernandezi* are few. Stuart (1935 and 1958) obtained a hatchling and a juvenile in May and March respectively in El Peten, Guatemala. Alvarez del Toro (1960) pointed out that in Chiapas this species lays three or four eggs between May and July. These are the only recorded observations for this species, and were summarized by Fitch (1970).

On September 10, 1980, near Coyame, Municipality of Catemaco, Veracruz, Mexico, in an humid and shady area of tropical rain forest, I watched a robust female of *C. hernandezi* for about 90 minutes in the process of oviposition on the ground, not in an excavation, near a tree. Upon completion of egg-laying, the female covered the eggs with dead leaves, utilizing a side of the body and with help of the head, then departed. Seven white eggs, delicately shelled, were taken from the nest. Their mean dimensions were: length 30 mm, width 20 mm, and weight 15 gms. All were placed in humid sand and kept in an obscure place at ambient temperature (22-30°C) to incubate.

On 16 November, after 67 days, the first two eggs hatched, and the others over the next three days. The time elapsed between first rupture of the eggs and emergence of the hatchlings was about 16 hours. All emerged during the day, none at night. All hatchlings were at once of normal coloration: lustrous brown or gray with a dark brown spot on the lateral pectoral region and a part of the humerus; a small anterior middorsal spot; transverse bands on the tibia and tail; and two to four white labials. Mean dimensions (mm) of the hatchlings: length s-v 35; tail 55; femur 10; tibia 10; foot 15; head 13; head width 9; eye diameter 1. From the moment of hatching the yound had the ability to run and climb. The seven are still retained alive.

At an earlier time (in 1979), a captive female laid five eggs in mid-September also, but they were not discovered until after they were infected with fungi, which killed them.

These and other personal observations on the nesting season of reptiles in the Los Tuxtlas region are not in accordance with observations on the same species by others elsewhere. In *Corytophanes hernandezi*, for example, Stuart (*loc. cit.*) and Alvarez del Toro (*loc. cit.*) give the oviposition dates as March and July in Guatemala and Chiapas respectively. If two months are required for incubation (as I observed), the hatching date in the two cases would be in the hot season with summer rains. In my observations, however, the oviposition dates fall in the last and most rainy month of the year, with hatching in the still rainy but coldest months of the winter. Very likely, the species lays several clutches over an extended breeding period, as is known for numberous other oviparous species (Fitch, 1970).

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TEMPERATURE EFFECTS ON LOCOMOTOR PATTERNS IN THE WOOD TURTLE, *CLEMMYS INSCULPTA*

According to Ernst and Barbour (1972) the wood turtle *Clemmys insculpta*, is diurnal and often wanders about on land during midday. The same authors indicate that next to box turtles (*Terrapene*) and tortoises (*Gopherus*), this is the most terrestrial turtle in the United States. The phase of the locomotor activity in the freshwater turtles, *Chrysemys picta*, *Clemmys guttata*, *Emydoidea blandingii*, and *Sternotherus odoratus* has been shown to shift in response to changing ambient temperature (Graham, 1979; Graham and Hutchison, 1979). The present study examines the locomotor rhythm of the more terrestrial emydid, *Clemmys insculpta* at constant (25 and 15C) and transitional (25-15C) temperature.

Three adult female wood turtles, *Clemmys insculpta*, were collected from Oakham and Rutland, Worcester County, Massachusetts in April and May, 1979. They were acclimatized in a constant temperature incubator for ten days at 25C, LD 14:10. The incubator (Freas 815, Low Temp) was equipped for twilight simulation (Graham and Hutchison, 1977) and the animals were wired for activity recording per Graham and Hutchison (1978), except that epoxy instead of vinyl electrical tape was used to secure the mercury microswitch to the carapacial dome of each animal.

Turtle movements were recorded for five days at 25C, five days during a transition to 15C (2C/day), and three days at 15C. The resultant activity of one typical female, graphed as mean hourly percentage of the 24 h. total, is presented in Fig. 1.

At 25C (constant) these turtles, as evidenced by the female record in Fig. 1, showed multiple activity peaks. During the five day temperature transition, the number of peaks in the daily cycles became reduced until at 15C (constant) the records were distinctly unimodal (single peak). This phase response is quite similar to that of *Emydoidea blandingii*, tested under very similar conditions, but the resultant unimodality in *Clemmys insculpta* at 15C is much more clearly defined. This is probably due to the more pronounced terrestriality of *C. insculpta* because terrestrial environments are much more thermo-labile than aquatic environments. We might therefore expect terrestrial species

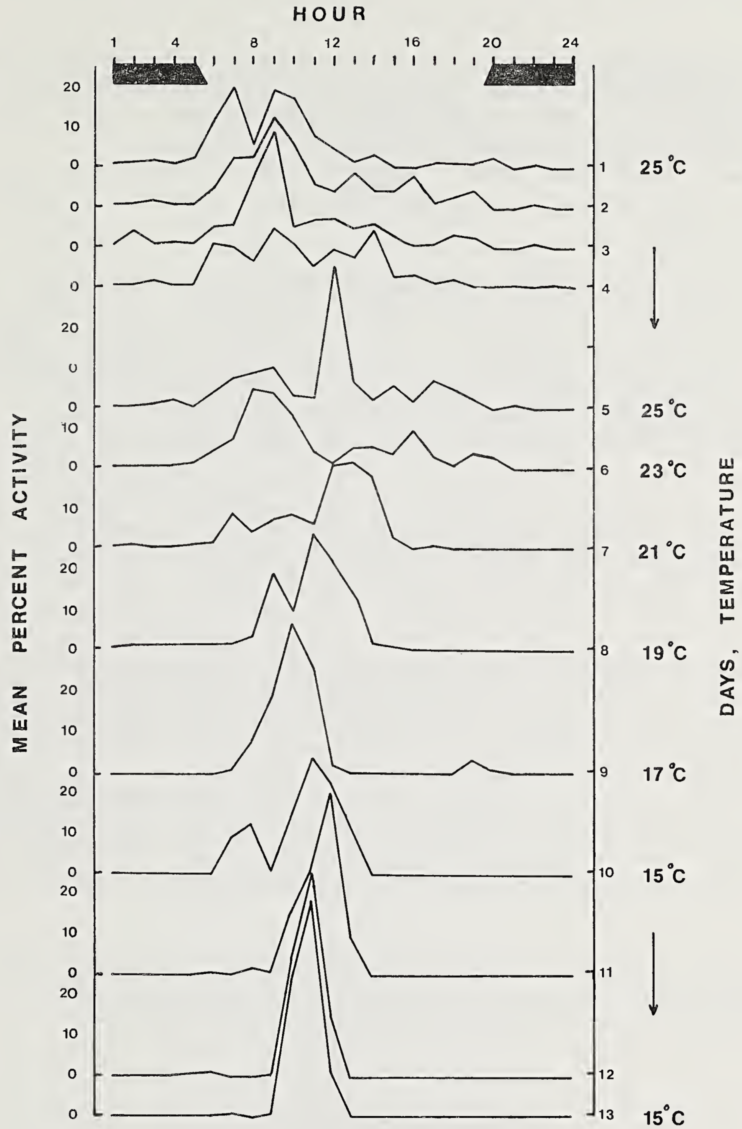

Fig. 1. The effect of downward temperature shift (days 6-10) from 25C (days 1-5) to 15C (days 11-13) on the locomotor rhythm of an adult female *Clemmys insculpta*. Activity is expressed as mean percent of diel activity for each hour; the scotophase is indicated by the black bars atop the stacked records.

to demonstrate greater sensitivity to temperature change, and thereby adjust their activity cycles sooner to changing ambient temperature. This adjustment can be seen from Fig.1 where the transition from multiple activity peaks to a single dominant peak took place during the temperature transition period, not after it as was the case with *E. blandingii* (Graham, 1979).

Additional data, not included in Fig. 1, indicate that this animal was 96-97% diurnal at 25C, but was 100% diurnal (no movements occurred in the darkness) at 15C. The temperature drop thus enhanced the highly day-active tendencies as the activity became more confined near midday. Activity was spread over an average of 18.4 h/day at 25C, 11.6 h/day at 25-15C, and 6.7 h/day at 15C. Average movements per hour were 108.8 at 25C, 153.4 at 25-15C, and 84.7 at 15C. These results indicate that not only was this individual strictly day-active, but she was also active over far fewer hours at 15C; her level of activity (average movements per hour) was reduced by the lower temperature. It is interesting that activity level during the temperature transition increased from 108.8 to 153.4. This response may represent avoidance behavior whereby the turtle was attempting to seek shelter or select a higher ambient temperature level by relocating. The suppressed activity (hours and movements per hour) would be expected as a consequence of the metabolism being lowered by decreased body temperature. The phase response of the activity rhythm of *C. insculpta* to changing ambient temperature may be adaptive, because by confining movement toward the middle of the photophase at 15C (Fig.1), this animal would be moving when field temperature would be more optimal for activity.

We thank Madelene Linck and Joe DePari for the loan of their specimens. Worcester State College provided a mini-grant for the purchase of the event recorder and supplies.

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—— Terry E. Graham. *Department of Biology, Worcester State College, Worcester, MA 01601,* and
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Accepted: 28 February 1981

SCELOPORUS AND *EUMECES* IN THE DIET OF *AMEIVA UNDULATA AMPHIGRAMMA* (LACERTILIA: TEIIDAE)

The known feeding habits of the lizards of the genus *Ameiva* indicate a diet consisting of arthropods. *A. festiva, A. undulata,* and *A. quadrilineata* of Costa Rica (Fitch, 1973) contained amphipods, tenebrionid beetles, pupae and eggs of insects, and lycosid spiders in their stomachs. *A. undulata podarga* of northeastern Mexico is reported (Axtell, 1958) to feed upon beetles, larvae, spiders and roaches. *A. undulata* of southern Mexico is said (Alvarez del Toro, 1972) to prey on insects, and we have observed the same for *A. u. amphigramma* from Veracruz. It is accordingly surprising and of interest to note the occurrence of small vertebrates in the diet of *Ameiva.*

In March, 1980, some specimens of *A. u. amphigramma* were collected by students of biology in the vicinity of Balzapote (Km 32 of the Catemaco-Montepio road), southern Veracruz. The larger specimens were examined by me. One had a lizard (*Sceloporus teapensis*) in the stomach, another the body of an small skink (*Eumeces sumichrasti*). The stomach contents were still well conserved, but both food specimens had lost the tail. It may be surmised that any lizard capable of caudal autotomy would lose its tail when attached by a predator, but it would be of interest to document that assumption. Some relation with the feeding systems used by predators is likely. Moll and Smith (1967) found two lizards in the stomach of a caecilian, both with an incomplete tail.

Sceloporus teapensis is active in open areas, while *Eumeces* inhabits forested areas, but *A. u. amphigramma* occurs in both habitats.

Ameivas frequently exhibit aggressiveness towards other small reptiles which are competitive with them, but our observations do not indicate whether such attacks are motived for territorial defense or predation.

Acknowledgement

Thanks are due to Dr. Hobart M. Smith of the University of Colorado for revision of the manuscript, and to M.en C. Andrés Reséndiz of the Instituto de Biología U.N.A.M., for collection of the specimens here reported.

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—Gonzalo Perez-Higareda, *Estacion de Biologia Tropical "Los Tuxtlas", Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Apartado Postal 51, Catemaco, Veracruz, Mexico.*

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Accepted 31 March 1981

OVIPOSITION OF *KINOSTERNON L. LEUCOSTOMUM* IN CAPTIVITY

(Testudines: Kinosternidae)

Few observations have been recorded on nesting or oviposition of the tropical species of the genus *Kinosternon* in Mexico. Most data on the reproductive cycles in this genus pertain to species of North or Central America; notable is the work of Iverson (1977, 1979A, 1979B), on *K. subrubrum* and *K. baurii;* Christiansen and Dunham (1972), on *K. f. flavescens;* Legler (1966), on *K. angustipons;* Sexton (1960), on *K. scorpioides;* and Medem (1961), on *K. dunni.* The only known observations on Mexican species are those of Alvarez del Toro (1972), for *K. abaxillare* and *K. cruentatum* of Chiapas. The following notes on *K.l. leucostomum* are accordingly of special interest.

An adult female of the latter species was collected in August, 1980, in Lake Catemaco, Veracruz, and kept in captivity in a small and improvised tank. On September 28, one month after capture, the specimen deposited six eggs on the surface of sand in the tank. They were white, with a rigid but fragile shell. Three were recovered in perfect condition (the other three were destroyed); they measured 37-40 mm in length, 23 mm in width, and weighed 14-16 gms. Although the species is smaller, its eggs are larger and heavier than those of *Pseudemys scripta* I have observed in Veracruz. The three eggs recovered were incubated in humid sand but did not hatch.

Kinosternon l. leucostomum is distributed in Mexico in the states of Veracruz, Tabasco, Oaxaca and Chiapas (Smith and Smith, 1980), and is abundant in almost all the lakes, streams and swamps of the low plains in central and southern Veracruz, from the basin of the Panoaya river southward (Perez-Higareda, 1978, 1980). Villagers in Veracruz report that in their vicinity this subspecies deposits its eggs on land near water in nests a few centimeters in depth, but I have no personal observations on nesting behavior in the natural ambient, nor on the number of eggs load.

Acknowledgement

Thanks are due to Dr. Hobart M. Smith of the University of Colorado, for his help in revision of the manuscript.

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—Gonzalo Perez-Higareda, *Estacion de Biologia Tropical "Los Tuxtlas", Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Apartado Postal 51, Catemaco, Veracruz, Mexico.*

Received 25 March 1981
Accepted 7 April 1981

NEWS AND NOTES

ATTENTION:

FIFTH ANNUAL REGIONAL HERPETOLOGICAL SOCIETIES CONFERENCE

DATE: 9 August 1981

TIME: 1300 Hours

PLACE: Psychology Auditorium
Memphis State University
Memphis, TN

TOPIC: Symposium - Alien Amphibians and Reptiles: The Problem of Introduced Species.

After the presentation, there will be a dinner and a slide show.

Speakers are still needed for the alien herp. symposium. If one of your members has been working with introduced herps and is interested in giving a presentation, they should contact: John C. Murphy, 201 Peerless Drive, Plainfield, IL 60544. Phone 815/436-8167.

It is hoped that all regional societies will send at least one representative to the conference. People attending are encouraged to bring their best dozen slides for the evening slide presentation.

News and Notes

The Sigma Xi Club of Towson State University will host a symposium on the 3rd and 4th of this coming September to consider endangered plants and animals in Maryland.

Thirty five authoritative presentations will be made, discussing a wide variety of species and groups of plants and animals (including invertebrates, vertebrates, cryptograms and vascular plants), areas and types of habitat that are critical to the survival of these species in Maryland, and applicable private, state and federal programs.

Of special interest to Maryland Herpetological Society members will be individual presentations concerning the Green Salamander, Hellbender, Jefferson Salamander, Tiger Salamander, Bog Turtle, Coal Skink and Mountain Earth Snake.

For additional information, contact Arnold Norden (301/685-3105) or Don Forester (301/321-2385).

Arnold Norden
Natural History Society of Maryland
2643 North Charles Street
Baltimore, Maryland 21218

Proceedings of the

MELBOURNE HERPETOLOGICAL SYMPOSIUM.

held at

The Royal Melbourne Zoological Gardens,
Victoria, Australia

19 - 21 May, 1980.

Edited by Chris B. Banks and Angus A. Martin, and published by the Zoological Board of Victoria.

. a collection of 35 papers and expanded abstracts covering Australian frogs and lizards, venom research, tortoises and turtles, and Australian crocodiles. Further papers discuss such topics as reptile diseases, herpetological communities, conservation and taxonomic studies. Many noted herpetologists are represented.

. an important addition to any herpetologist's library.

ORDER FORM

Copies are available for $12.00 (Australian) each, including postage and handling.

. from Symposium Secretary, The Royal Melbourne Zoological Gardens, P.O. Box 74, Parkville, Victoria, 3052, Australia.

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Please send ________ copies @ $12.00 (Aust.) each

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NEW BOOK RELEASE:

BOOK NEWS FROM BLANDFORD: NOTED EXPERT PRESENTS INTRIGUING PORTRAIT OF POISONOUS SNAKES IN AUTHORITATIVE NEW GUIDE.

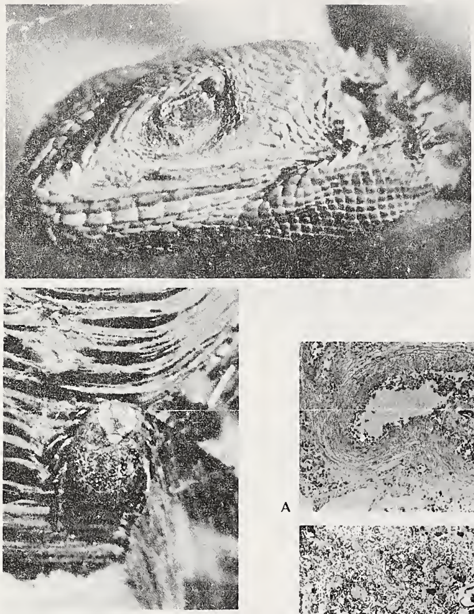
TITLE:	POISONOUS SNAKES
PRICE:	$27.50
PUB. DATE:	APRIL 27, 1981
ISBN:	0-8069-9894-6

When most people see a snake, they very quickly head in the opposite direction. Tony Phelps is an exception to that rule. In fact, he chases after them, searching through fields and even climbing trees in hot pursuit not merely of snakes in general, but specifically the poisonous species -- and he's been doing this since age 8, when he caught his first adder. Now, 15 snakebites and well over 5,000 captures later, Mr. Phelps serves as curator of one of the world's largest collections of venomous snakes, and has taken some time away from his slithery charges to write an immensely readable guide to their true nature. POISONOUS SNAKES, published April 27 by Blandford Press and distributed by Sterling ($27.50), dispels common myths and misconceptions and reveals the secrets of handling, capturing, and caring for poisonous snakes, a topic which the public rarely hears about.

Drawing on his extensive firsthand experience, Phelps covers each species in detail, describing their physical characteristics, habits and habitat, with special attention to their feeding and breeding patterns, and the ecological balance between the snakes and their natural predators. His extensive discussion of the relationship between snakes and man features a fascinating analysis of the effects of venom on the body, along with a survey of snake handling ranging from snake charmers to laboratory researchers, with profiles of the great "snakemen" of our time. The last two sections, dealing with the ins and outs of capturing poisonous snakes in the field -- and keeping them in captivity -- will be as valuable to professional herpetologists as they are intriguing to the general reader.

cont . .

Complete with 33 close-up color photographs of venomous specimens and numerous black-and-white photos and line drawings, POISONOUS SNAKES is an eye-opening account of some of the world's most talked-about but little understood creatures.



A

B

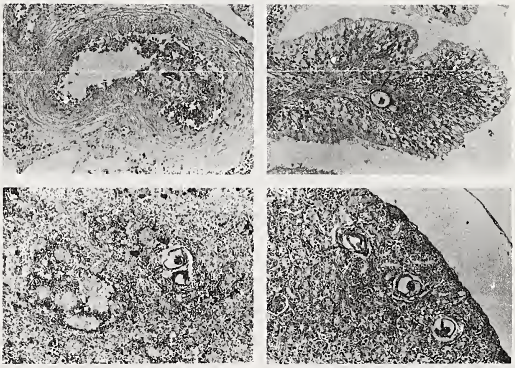
Fig. 3-79. A. Tick with mouthparts imbedded in the lateral canthus of the eye in an Agamid lizard. B. Adult female ixodid tick feeding on the carapace of an East African tortoise.

VETERINARY BIOLOGY AND MEDICINE OF CAPTIVE AMPHIBIANS AND REPTILES

MARCUS

Published by LEA & FEBIGER

Printed in U.S.A. 3-81



A B C D

Fig. 3-51. Spirorchid eggs (arrows) in a western painted turtle *(Chrysemys picta belli)*. 125X. A. In a thrombus, with a giant cell formation, mesenteric artery. B. Intestine. C. Spleen. D. Kidney. Similar lesions were seen in the heart, thyroid, pancreas, liver, and lung of this animal.

Contents

NOTES:

Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

Information for Authors

All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $6.00.

Reprints are available at $.03 a page and should be ordered when manuscripts are submitted or when proofs are returned. Minimum order is 100 reprints. Either edited manuscript or proof will be returned to author for approval or correction. The author will be responsible for all corrections to proof, and must return proof preferably within 7 days.

The Maryland Herpetological Society
Department of Herpetology
Natural History Society of Maryland, Inc.
2643 North Charles Street
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BULLETIN OF THE

Maryland Herpetological Society

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DEPARTMENT OF HERPETOLOGY
THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

MDHS........A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

SEPTEMBER 1981 VOLUME 17 NUMBER 3

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

Volume 17 Number 3 September 1981

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The Maryland Herpetological Society
Department of Herpetology
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BULLETIN OF THE

mdhs

Volume 17 Number 3 September 1981

The Maryland Herpetological Society

Department of Herpetology, Natural History Society of Maryland, Inc.

Library of Congress Catalog Card Number: 76-93458

Membership Rates

Full membership in the Maryland Herpetological Society is $12.50 per year, subscribing membership (outside a 20 mile radius of Baltimore City) $10.00 /year, Foreign $12.00/yr. Make all checks payable to the Natural History Society of Maryland, Inc.

Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May-August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

Volume 17 30 September 1981 Number 3

AN ANNOTATED CHECKLIST TO THE SNAKES OF THE MOYAONE RESERVE, PRINCE GEORGE'S COUNTY, AND CHARLES COUNTY, MARYLAND

The only publication of which I am aware that makes any reference directly to the snakes of the Moyaone Reserve and surrounding area is entitled "Land Use Survey of Piscataway Park,", 1963, prepared by the National Park Service. The publication states "Only two species of snakes were seen, the banded watersnake along the Potomac and in the artificial lake, and a black snake, either the blue racer or a black rat snake." I think the above quotation points to a large gap in the knowledge of the serpent life of this area. Consequently, this "Checklist" has been prepared.

This paper is a preliminary account of the occurrence and distribution of serpent populations in the Moyaone Reserve and its environs. The material presented is based largely on the author's personal observations and is therefore unavoidably biased in its content. Finding snakes is often a matter of chance and certain species may be much more abundant than is indicated. Included are several species that should occur here (Conant, 1975; Harris, 1975; Kelly, 1936; McCauley, 1945), but as yet have remained unobserved.

A number of common names are given for each species. In the notations, a general description of size and pattern is given. Remarks on the habits, habitats, and relative abundance are presented. The author has attempted to add interesting comments concerning the natural history of each snake in the area.

A brief description of the region's geologic structure, dominant vegetative types, and associated vertebrate animal populations is given.

It is hoped that the human residents of the Moyaone Reserve will gain an ever increasing interest in and appreciation for the serpent life with which they share the environment.

Introduction

The Moyaone Reserve is situated in southern Prince George's County and extreme northwestern Charles County, and is located northwest of the town of Accokeek, Maryland. The Reserve and environs cover a land area of roughly six square miles including about seven miles of waterfront along the Potomac River and Piscataway Bay. The area is on the Western Division of southern Maryland's Coastal Plain Province and is included in the Carolinian Life Zone.

During past geologic time the region was inundated by oceans and the underlying strata is predominantly a deposition of marine sediments consisting of unconsolidated clays, conglomerates, marls, sand, and silt. Later, the ancestral Potomac, often flooded by the ancient sea, formed a topographic series of terraces which slope toward the River's present course.

A number of small streams and dry washes form wide gullies and steep hillsides across the old terrace formations, and extensive erosional effects are readily apparent. Swamps and tidal marshes typically occur where the larger streams empty into the River. Often floodplains and accumulations of tidal debris are evident far up the streambeds indicating frequent periods of high water.

The deciduous forest is dominated by oak, hickory, beech, sycamore, and yellow poplar. The understory is commonly comprised of dogwood, sweet gum, and holly. Honeysuckle, poison ivy, greenbriar, and grape are often conspicuous floral elements. Stands of pine often occupy the better drained ridges. The arrow arum and the broad-leaved cattail grow profusely in the tidal marshes.

The woodland areas have been largely cut and converted to farmland, thus providing the region with a blend of climax forest and agricultural cultivation that is generally favorable to the wildlife community.

A number of hawks and owls make a home in the Reserve anu a host of insectivorous and seed-eating birds are common and abundant here. Mammals including foxes, raccoons, rabbits, rats, and mice are plentiful. Various kinds of lizards and turtles inhabit the region as well as several species of salamanders, frogs and toads. Carp, catfish, perch, and minnows abound in the area's waterways.

Snakes form an invaluable predator/prey function in the economy of nature. The various species of serpents fulfill intermediate links in the food chain. All snakes are carnivorous and prey upon a number of smaller animals. Snakes in turn fall victim to several larger predators.

Serpent distribution in the region has been greatly influenced by the physiographic and climatic changes which have occurred during or since the glaciation of the North American continent during the Pleistocene Epoch. Today with mankind's increasing numbers and his subsequent demand for living space, snake populations are often decimated because of habitat destruction. Many species have been exterminated from large parts of their former range.

ACCOUNT BY SPECIES - FAMILY COLUBRIDAE

Natrix sipedon sipedon, Linnaeus

Northern Water Snake, Common Water Snake, "Banded Water Snake", "Water Moccasin"

Adults average from 2 to 3½ feet in length and are usually a plain brownish hue above, however, bands are evident when the body is wet. A semi-aquatic serpent; common and abundant along the area's permanent waterways. Several individuals will congregate on brushy points or under debris along the River. Tidal marshes and woodland pools are favored habitats. The species feeds on fish, frogs, and some carrion. Often parasitized by a small roundworm that encysts itself under the skin.

Natrix septemvittata, Say

Queen Snake, Striped Water Snake, Leather Snake

A brownish snake with yellow stripe along each side of the body. The venter is light yellowish and has two rows of darker spots. Usually averages under 2 feet in length. A semi-aquatic snake that prefers swift flowing streams and feeds largely on crayfish. The species is found principally north of the Fall Line and is included in this Checklist as possibly occurring in the area. There are no specimens on record from the Reserve.

Carphophis amoenus amoenus, Say

Eastern Worm Snake, Ground Snake

Plain brown above, pink below; scales smooth and shiny. Adults 10-12 inches in length. A subterranean species often found under stones and stumps in moist woodland areas. Sometimes seeks concealment inside rotting logs where it follows the tunnels of the horn beetle. Very common and abundant, although not usually seen above ground except at night, especially after heavy rains. Feeds on earthworms.

Opheodrys aestivus, Linnaeus

Rough Green Snake, Keeled Green Snake, Grass Snake

A slender light green snake that averages 2-3 feet in

length. This primarily arboreal snake is difficult to see in the vines and brush of its normal habitat. Usually observed lying along the roadside where many are killed by passing cars. A common and abundant species. Feeds on insects and spiders.

Heterodon platyrhinos, Latreille

Eastern Hognose Snake, Puff Adder, Blowing Viper, Spread-Head Viper, Hissing Viper

A heavy-bodied snake about 2-2½ feet in length when adult. Variously blotched and spotted; sometimes quite colorful. Defensive behavior of this species includes puffing, hissing, and neck spreading. Will often feign death when disturbed. A terrestrial snake, frequenting dry woods and fields, where it feeds primarily on toads. Not uncommon in the Reserve. Hatchling specimens are usually found from late August through early October.

Diadophis punctatus edwardsi, Merrem

Northern Ringneck Snake, "Racer"

Black or slate grey above with a yellowish ring around the neck. Belly yellow, sometimes with rows of spots. Averages about 12-15 inches in length. A secretive species found beneath rocks and logs in moist woodland situations. A fairly common snake in this area. Food consists of small amphibians, notably the red-backed salamander. Earthworms and various other invertebrates are also consumed.

Farancia erytrogramma erytrogramma, Latreille

Rainbow Snake, "Eel Moccasin"

A shiny red and black striped snake, 3 or 4 feet in length. A burrowing serpent found near streams and clear springs. The species is quite rare in Maryland. Only a few specimens are on record from the state, none from the Reserve. Feeds primarily on eels.

Coluber constrictor constrictor, Linnaeus

Northern Black Racer, Blacksnake, "Blue Racer"

A dull black color above, sometimes marked with white on throat and chin. Smooth scaled. Adults usually under 5 feet in length. An active species found from swampy lowlands to forested hillsides and dry fields. Frequently observed climbing bushes and trees. A common and evenly distributed snake in this area. Food includes a wide variety of animal life from mice and frogs to small snakes and insects. Not a constrictor as its scientific name implies.

Elaphe obsoleta obsoleta, Say

Black Rat Snake, Blacksnake, Pilot Blacksnake, Mountain Blacksnake, Black Chicken Snake

A shiny black hue on back and sides with belly patterned with black and white markings. The species averages 4-5 feet in length, but larger specimens are occasionally found. This species is probably the most abundant snake in the Reserve. It may be found in fields, woods, around barns and outbuildings, or crossing a road. The species is active day or night and often climbs large trees to heights of twenty feet or more. Consumes large numbers of rodents and occasionally birds and bird eggs. Large individuals of this snake often show scars and evidence of old wounds, possibly from fox or dog bites.

Elaphe guttata guttata, Linnaeus

Corn Snake, Red Rat Snake, Mouse Snake, House Snake

This attractive snake is patterned with a series of black-bordered red blotches on back and sides of body. The venter is black and white checkered. Usually 3 or 4 feet in length. A congener of *E. obsoleta* and should be found in similar habitats, but thus far the Corn Snake remains unrecorded from the Reserve. Possibly the prevalence of the Black Rat Snake limits the distribution of the Corn Snake in our area. Feeds mainly on mice. Young specimens may eat lizards or small frogs.

Cemophora coccinea coccinea, Blumenbach

Northern Scarlet Snake

Colorfully marked with red "saddles" bordered by black along the back. Venter is white. Appears ringed when viewed from directly above. This snake averages under 2

feet in length. This species is extremely secretive and quite rare. It has not been recorded from the Reserve, but it does occur at localities not too far distant. It should be looked for under shelter in well drained soils. Reported to feed on reptile eggs.

Thamnophis sirtalis sirtalis, Linnaeus

Eastern Garter Snake, Common Garter Snake, Striped Snake, Garden Snake

An 18 to 24 inch brown or greenish snake, typically with three yellowish stripes running the length of the body. Sometimes appears more spotted than striped. A common and abundant snake found in a wide variety of habitats, but usually near moisture of some form. Individuals of this species have been observed in early March basking in the sun near a flowing spring. Feeds mainly on frogs, salamanders, and earthworms.

Thamnophis sauritus sauritus, Linnaeus

Eastern Ribbon Snake, Riband Snake, "Garter Snake"

A chocolate brown snake with three yellow stripes on back. The tail may comprise up to one-third of the total length, which is about 2 feet. The species is apparently less common than the Eastern Garter Snake as only a few specimens have been found in the Reserve. The Eastern Ribbon Snake is inclined towards aquatic habitats and feeds on fish and frogs.

Virginia valeriae valeriae, Baird and Girard

Eastern Smooth Earth Snake, Brown Snake, Valeria's Snake, "Ground Snake"

This 7-10 inch reddish brown or grey snake is very secretive. At times uncovered as it rests beneath boards, stones, or fallen logs. The species has a spotty distribution and seems to be uncommon locally. Food consists of various small invertebrates.

Storeria occipitomaculata occipitomaculata, Storer

Northern Red-Bellied Snake, Storer's Snake

A grey or brown snake above with four thin dark lines on back and sides of body; bright red belly. Usually under 10 inches in length. A secretive species sometimes found beneath debris in woodland habitats. May be found under cover as much as three feet above the ground. A fairly common snake, one of the first to emerge from hibernation; often seen in late March. Food includes earthworms and insects.

Storeria dekayi dekayi, Holbrook

Northern Brown Snake, Dekay's Snake, "Garter Snake"

Brown or tan above with two rows of small dark spots along back. Average length under 12 inches. Often found to be abundant under boards, tarpaper and trash heaps that provide hiding places in open areas or around houses. The species occasionally seems to occur in colonies. Feeds on earthworms and insects.

Lampropeltis triangulum temporalis, Cope

Coastal Plain Milk Snake, Milk Snake, Red King Snake, House Snake

With an average length of 2-3 feet, this attractive snake is patterned with a series of black-bordered red blotches on back and sides. A very uncommon species of the *L. triangulum* complex. No specimens are recorded from this area, although the form may very well occur here. The snake is apparently inclined towards burrowing habits in pinewoods associations. Small rodents and probably lizards and small snakes are included in its diet.

Lampropeltis calligaster rhombomaculata, Holbrook

Mole Snake, Brown King Snake

A reddish brown snake with a faint pattern of narrow red markings across middle of back. About 3 feet in length. A burrowing species occasionally found in recently plowed fields and under cover. Sometimes seen active above ground in the evening shortly before dark. A fairly common snake, but not often observed. Feeds on moles and mice.

Lampropeltis getulus getulus, Linnaeus

Eastern Kingsnake, Chain King Snake, Wampum Snake, Thunder Snake

A yellowish "chain-like" pattern on a shiny black ground color. Adults 3 to 3½ feet in length. This species displays a fondness for moist environments, but also occurs in dry fields, often hidden beneath scrap metal and other such shelter around old barns. Usually found active in late afternoon or evening. A fairly common snake in this region. Feeds largely on mice and young rats. Also eats other species of snakes, although not strictly venomous forms as is sometimes believed.

FAMILY VIPERIDAE - SUBFAMILY CROTALINAE

Agkistrodon contortrix mokeson, Daudin

Northern Copperhead, Highland Moccasin, Chunk-Head

Patterned with distinctive "hour-glass" markings along back. A copper red tinge on top of head. Averages 2 or 3 feet in length. This snake is partial to moist situations along the area's streams where it can find suitable cover. It is interesting to note that the Worm Snake, *C. amoenus*, is often a habitat associate of the Copperhead. Although nocturnal and not often seen, the Copperhead is not uncommon at certain localities in the Reserve. The species has been known to feed on mice, other snakes, and insects.

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A Record Size Female and Egg Clutch for the Bog Turtle *Clemmys muhlenbergi*

The bog turtle, *Clemmys muhlenbergi*, occupies a unique niche in the chelonian fauna of North America. Because of its specialized habitat, secretive habits, attractive size, and concern for its conservation, a wealth of information is available on this diminuative reptile. Indeed the literature, both scientific and semi-popular, is as voluminous for this turtle as for most other single species. Because of the interest in this turtle, I am prompted to report my observations on an unusual specimen of this species.

Babcock (1919, p. 401) mentioned that a carapace length of 4½ inches [114 mm] is occasionally attained in this species, but gave no details. This maximum value appears frequently in several field guides (Conant, 1975; Behler and King, 1979) and reference texts (Ernst and Barbour, 1972; Ernst and Bury, 1977; Pritchard, 1979). Based on actual measured specimens, Barton and Price (1955) observed the largest of 51 bog turtles to have a carapace length of 108 mm for a male (22 specimens) and 94 mm for a female (29 specimens). More recent data of Nemuras (1967) gave values of 106 mm for males and 95 mm for females from a total of 17 specimens from Pennsylvania and New York. Ernst (1977) reported a maximum of 105.5 mm for numerous Pennsylvania specimens (sex unspecified). The New Jersey specimens of Holub and Bloomer (1977) attained a length of 101 mm for a male and 91 mm for a female. Arndt's (1972) measurements of Delaware bog turtles had a maximum length of 96.3 mm for a female.

As regards the number of eggs in the single yearly clutch in this species, the maximum number quoted is usually five (5) (Arndt, 1972, 1977; Eglis, 1967; Ernst and Barbour, 1972; Zapplorti, 1978). A compilation of egg clutch size from both wild and captive specimens from the above and other literature sources shows an average of 3.72 ± 0.93 S D (n=50), range 2-5 with a mode of 3. However, Behler and King (1979) mentioned a clutch size of six (6) eggs in the bog turtle but gave no details.

In May, 1971, I obtained an unusually large female specimen of *Clemmys muhlenbergi* from Lebanon County, Pennsylvania. The shell measurements of this turtle taken with calipers to the nearest 0.1 mm are tabulated in the Table (values given are the longest straight line measurements).

The carapace length of this "giant" female bog turtle is almost 11 mm longer than the largest female so far recorded and just over 2 mm shorter than the largest male definitely known. At the same time, measurements of three other specimens from Pennsylvania are included in the Table. One of th-se is believed to be a normal sized female and the other two are large males and, although they are above average size, they are smaller than the large female. As observed by Barton and Price (1955), sexual dimorphism is expressed in a lower carapace to plastron length ratio in the female. This ratio is also apparent with these four turtles.

On 1 July, 1971, a hot (25°C) and sultry day, this same large specimen laid, outside in a mossy substrate, a record clutch of six (6) eggs which measured 28.3 $\pm$ 0.8 mm in length and 15.4 $\pm$ 0.5 mm in width. All six eggs were fertile and, after 48-50 days incubation at 25-28°C, all hatched although one embryo was stillborn. Dimensions of the five surviving hatchlings ten days after birth were: carapace length of 28.6 $\pm$ 0.5 mm and plastral length of 22.4 $\pm$ 0.5 mm. Moll (1979), in his excellent review of reproductive cycles in turtles, states that clutch size increases with body size and age, although the trend is not always evident and may be absent in species laying small clutches. It is interesting that the large clutch size reported here also originated from an oversized specimen. The female specimen did appear to be relatively young as the concentric markings on the carapace were well-defined and not smooth as would be expected for an older specimen.

A similar type record size female specimen from the Emydid family, *Terrapene carolina carolina*, has been found recently in upstate New York (Cook, Abb and Frair, 1972). In this instance, the box turtle was a female and surpassed by over 14 mm in carapace length the largest member, either male or female, of this subspecies. Again, from its shell characteristics, it did not eppear to be much past its prime although its shell was abnormal in being somewhat bilobed. Unfortunately, the large female was not reported to lay eggs so a clutch size is not available. Recently, Pritchard (1980) gave some interesting examples of record size specimens from Florida, among which were the genera *Terrapene*, *Graptemys*, and *Pseudemys*.

In the last few years, evidence has accumulated (Arndt, 1977; Behler and King, 1979; Pitts, 1978) that the bog turtle is more common than imagined although it is secretive. The observations presented here add to our knowledge of this species in particular and to unusual sized specimens in general.

Table 1.

Shell Measurements (mm) of Four Bog Turtles from Pennsylvania

Specimen	CL[1]	PL[2]	CW[3]	PW[4]	CL/PL
Large Female	105.8	94.9	76.6	53.9	1.11
Normal Female	90.7	82.3	68.8	46.7	1.10
Large male 1	101.7	88.5	73.4	48.0	1.15
Large male 2	99.4	84.8	74.2	45.6	1.17

1 - Carapace length
2 - Plastron length
3 - Carapace width at widest point
4 - Plastron width at femoral scute just posterior to bridge

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An Observation on Winter Emergence of a Garter Snake, *Thamnophis radix*

Occasional records are puzzling of winter emergence at unseemly temperatures of some reptiles, all of which are known to be unable to survive freezing and to be capable of only limited movements at temperatures well below their normal activity range. A recent local observation on the Plains garter snake, *Thamnophis radix haydeni* (Kennicott), is suggestive of an explanation for at least some abnormal winter emergences of reptiles.

The winter of 1980-1 in Boulder, Colorado, was an exceptionally mild one with no night temperatures recorded below $-11^{\circ}C$ prior to 2 February, 1981, and day temperatures almost always rising above $0^{\circ}C$. The night of 2 February, 1981 had an official low of $-14^{\circ}C$. The following day warmed to $4^{\circ}C$, with occasional periods of sunshine (all temperatures courtesy NOAA). On that day a subadult *Thamnophis radix* (female, 410 mm s-v, 543 mm total length) was found lying immobile in the grass opposite a hidden recess under the sidewalk two feet away. That species is quite common in that area of the city, local children catching dozens of them during warm parts of the year, particularly in the fall when neonates are abundant.

It may be conjectured that until 3 February, the snake had successfully survived the winter in the recess opposite which it was found.

When the snake was observed 3 February, it was taken into a house and kept under observation in a cage warmed with an incandescent bulb to about $23^{\circ}C$ and provided with shelter and water. Food (earthworms) was offered but refused, although local garter snakes apparently thrive largely upon that diet. Even when warmed, the snake exhibited abnormal movements characterized by periods of normal locomotion alternating with periods of partial loss of the righting reflex. It would briefly move sinuously upside down before righting itself, and often held its body at an angle. Although capable of coiling, it spent most of its time stretched out with just one or two juxtaposed (hairpin) loops in the body. In general the snake's locomotion could be characterized as spasmodic and uncoordinated. The snake died 6 February despite maintenance under favorable conditions.

The behavior of the snake when found and as kept in captivity suggests that neuromuscular damage had been

suffered, presumably from exposure to cold insufficient to kill outright, but sufficient to induce uncoordinated movement that resulted inadvertently with emergence onto the surface of the ground where the snake, had it remained undiscovered, undoubtedly would soon have died with direct exposure to subzero temperatures.

These observations suggest that some unusual winter emergences of reptiles may follow brief exposure to immediately sublethal cold temperatures when followed by a warming trend. The effect is apparently the production of uncoordinated movements that end either soon with exposure to lethal cold, or somewhat later as a result of irreversible neuromuscular impairment. The novelty of this hypothesis lies primarily in the possibility that exposure to cold can, in at least some reptiles and at certain temperatures, actually induce movement instead of progressively paralyzing it as may be deduced under controlled conditions to be the expected result of temperatures decreasing to lethal levels.

Undoubtedly the induction of movement as a result of partial freezing requires thawing temperatures; maintenance of the freezing temperature would presumably cause death without movement. However, a partially frozen snake, such as the observed garter snake, will apparently start moving when subjected to rising temperatures, at much colder levels than a snake that was not partially frozen. Such movements would be the equivalent of the death throes of a mortally injured animal -- movements physiologically unrelated to survival but occurring as a result of lethal changes that, once effected, initiate a chain of events dictated by the particular sort of physiological degeneration characteristic of the given animal. Death throes in endotherms are characteristically intense and brief; in reptiles they are notoriously protracted and less vigorous.

Alternatively it is possible that adaptive rather than necrogenous movement may be induced by warming temperatures after near-lethal as well as lethal cold exposures. A survival value of movements induced by cold is certainly conceivable if they were frequently to lead to a longer reproductive life than would be possible otherwise. Whether movement can be induced in snakes or other reptiles by slight temperature increases after near-lethal cold exposure is not known, however. It merits experimental exploration.

Experimental studies on the congener *T. eques* (Lowe, Lardner, and Halpern, 1971:127) revealed a lowest temperature tolerance of $-5.48^{\circ}C$. The presumed hibernation site of the garter snake reported here obviously protected it from temperatures $5.5^{\circ}C$ below that recorded as lethal, but not

8.5°C. These authors likewise showed (op. cit.:132) "that species of snakes and lizards may temporarily survive limited superficial freezing (ice formation) but are, nevertheless, ecologically dead, since they show severe neuromuscular discoordination to the extent that they can neither feed themselves nor remove themselves from immediate unfavorable environmental events." The actual induction of movement, uncoordinated or not, was not noted in the report of Lowe et al. nor in Spellerberg's (1976) review and remains to be confirmed by further studies of the effects of limited freezing.

The work by Lowe et al. also documents the astonishing ability of reptiles to withstand subfreezing temperatures even as low as -8°C (their experiments) in some species, without freezing (i.e., by supercooling). The phenomenon loses its mystery with recognition that, depending on the solutes present, ice may not form in water until the temperature reaches as low as -39°C (op. cit.:130). It is apparently the actual formation of ice in tissue fluids that wreaks irreversible injury, not the temperature itself.

Thus it can be concluded that the garter snake here reported was not exposed to its supercooling limit until the night of 2 February, when it suffered partial freezing that was irreversibly although protractedly lethal.

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Two New Reptile County Records for Maryland

According to Harris (1975), the eastern garter snake, *Thamnophis s. sirtalis*, has been recorded from every county in Maryland except Wicomico County. Since moving to Wicomico County in late 1978 my son, Charles Grogan, and I have encountered numerous specimens of this species in the Salisbury area where it is apparently very common. An adult female found DOR on 2 May 1981 in Parsonsburg, Wicomico County, is catalogued R2606NHSM in the collection of the Natural History Society of Maryland and represents a county record for Wicomico County.

Harris (1975) also indicates that the northern fence lizard, *Sceloporus undulatus hyacinthinus*, has been recorded from every Maryland county except for Garrett, where it probably does not occur, and Dorchester. During late June, 1979 my son Charles was attending the Nanticoke Boy Scout Reservation, 2.5 miles SW of Galestown in Dorchester County. He and his friends captured several fence lizards which were apparently fairly common on the loblolly pines near the Nanticoke River. A juvenile male of this species taken at the above locality on 30 June 1979 by William Morgan III is catalogued R2607NHSM in the Collection of the Natural History Society of Maryland and represents a county record for Dorchester County.

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SNAPPING TURTLE PREDATION ON RING-BILLED GULLS

The snapping turtle (*Chelydra serpentina*) has been known to feed on a variety of vertebrates, especially fish and waterfowl (Surface, 1908; Pell, 1940; Alexander, 1943; Lagler, 1943; Coulter, 1957; and Hammer, 1969); but while snapping turtles seem capable of capturing live waterfowl as well as other vertebrates, there is little information on their predatory habits in natural settings. Published observations of snapping turtle predation on wildlife include those of Edminster (1953) for the ring-necked pheasant (*Phasianus colchicus*) and Abbott (1884) for the mink (*Mustela vison*). The following report details observations of snapping turtles capturing and feeding on ring-billed gulls (*Larus delawarensis*).

Observations of the natural foraging behavior of snapping turtles were made during 1977 while conducting turtle studies at Cranberry Creek Marsh in Jefferson County, New York (Petokas, 1979). Cranberry Creek is a slow-flowing, meandering tributary of the St. Lawrence River, the creek's channel averaging about two meters in depth. Littoral areas are vegetated primarily with cattail (*Typha spp.*), big bur-reed (*Sparganium eurycarpum*), tussock sedge (*Carex stricta*), and swamp loosestrife (*Decodon verticillatus*). The upland areas are predominately forested and have been described elsewhere (see Petokas and Alexander, 1980). Flocks of ring-billed gulls foraged daily in summer at a garbage dump adjacent to the marsh. The gulls regularly left the dump in flocks of 10-40 to settle along a 100-meter section of the creek where they drank and preened. The gulls rarely flew to other parts of the creek; all observed predation occurred in the more regularly used section of creek channel.

The first sign of predation by snapping turtles was recorded on 3 July 1977. A single ring-billed gull, appearing to be freshly killed, was observed floating at the margin of the creek channel at 1145 hours. Directly beneath the gull was a large algae-covered snapping turtle lying on the creek bottom. Capture of the turtle was attempted, but this individual and others observed subsequently escaped successfully because of their extreme wariness while feeding and the obvious difficulty of hand capture in water depths of 1-2 meters. Other ring-billed gull carcasses were observed on 11 and 13 July in the same general area. On both occasions, the gulls appeared to have been freshly killed. A fourth ring-billed gull carcass was found floating on the creek on 15 July at 0800 hours. This individual was apparently one of several gulls that frequented

the marsh for extended periods, showing signs of poor health. The gull was intact, showing no sign of predation, but later the same day (1300 hours) a painted turtle (*Chrysemys picta*) was observed feeding on the floating carcass. It was a common occurrence to see painted turtles feeding on the remains of predated gulls; however, painted turtles and snapping turtles were never observed concurrently in the vicinity of gull carcasses.

Actual prey capture was observed on 15 July at 1755 hours. A large snapping turtle (presumably an adult male) was seen with its jaws clamped over the posterior body section of an adult ring-billed gull. The bird flapped wildly and emitted vocalizations (squawks) until weakened (or possibly in shock), after which the turtle released its grip on the gull and submerged. The turtle resurfaced several times near the gull, which was still flapping weakly; but by then the turtle seemed aware of my presence and it did not attempt to feed on the disabled bird. I then left the site to continue other field studies and made no further observations on this activity.

On 17 July at 0740 hours, a large snapping turtle was observed feeding on a ring-billed gull at the center of the creek channel in close proximity to the 15 July observation site. As I neared the floating gull carcass, the turtle submerged and resurfaced nearby, only to again submerge and not to be seen again. I examined the gull carcass and noted that the posterio-ventral portion of the body, including part of the breast, had been torn away. The condition of this particular individual was typical of most gull carcasses examined at Cranberry Creek Marsh. Additional ring-billed gulls were found in the same area and in a similar condition on 20 July (Fig. 1) and 3 August.

The even temporal spacing and localized site specificity of the above described predation suggests that a single individual turtle may have been responsible for the majority of gull predation at Cranberry Creek Marsh. The repeated observation of a single adult male snapping turtle in the area supports this presumption; however, there was no means of identifying the individuals sighted, since they could not be caught during their predatory activities. Large (old?) adult snapping turtles seem to restrict their activities to small, well-defined areas (Abbott, 1884; Surface, 1908; Pell, 1941; and Kiviat, 1980), and it is possible that one individual turtle encountered gulls several times while foraging, thereon developing a search image for an avian food resource.

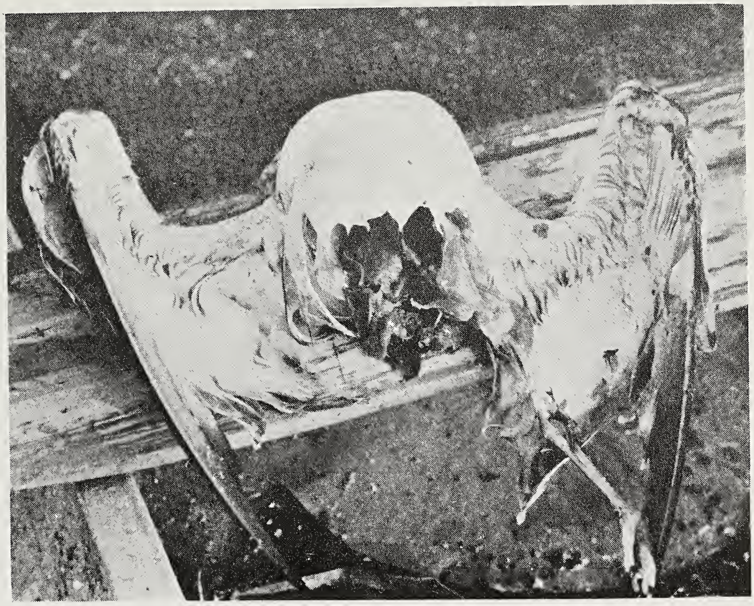

Figure 1. Ring-billed gull carcass showing posterio-ventral portion of body and right leg torn away by a snapping turtle (0700 hours, 20 July 1977

A recent observation at Goodale Lake in central New York demonstrates that snapping turtles also prey on live adult waterfowl. On 17 June 1980, at 1915 hours, an adult female mallard (*Anas platyrhyncos)* was observed flapping her wings wildly in a stand of swamp loosestrife. As I approached, a snapping turtle raised its head from the water with the neck of the mallard grasped between its jaws. The turtle relowered its head and held the mallard submerged long enough to drown her. Nearby, the mallard's brood lay hidden among swamp loosestrife tussocks. It is possible that I had frightened the mallard, causing it to take the brood into a vegetation stand where the snapping turtle lay submerged, or perhaps the hen was captured while dabbling. The latter alternative seems more plausible; however, initial prey capture was not observed.

Acknowledgements

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BOOK REVIEW

SYNOPSIS OF THE HERPETOFAUNA OF MEXICO, VOL. VI: GUIDE TO MEXICAN TURTLES: BIBLIOGRAPHIC ADDENDUM III. By Hobart M. Smith and Rozella B. Smith. North Bennington, Vermont, John Johnson, 1044 pp., 64 pls., 46 maps, 1980. Hardbound, $40.

No reviewer, with the limited space available to him, could possibly do justice to this extraordinary volume and the immense amount of detail it contains. Its scope and magnitude are awesome, and it stands as yet another monument to the encyclopedic knowledge of Hobart M. Smith, one of the great herpetologists of all time, and the skill and devotion of his wife, Rozella B. Smith, whose competence with computers enabled her to record and manage an incredible mass of information for retrieval in many different ways.

Unquestionably this book qualifies as an indispensable unit in the library of any serious-minded cheloniologist. The largest portion of the text (622 pages) is concerned with systematic accounts and supporting data for the 130 taxa, ranging from subclass to subspecies, that are used by the authors, and all of which are treated in great detail. This section includes 63 kinds of turtles considered to be part of the Mexican fauna, among them one recently extinct form (*Trionyx spiniferus ater*) and two others (*Chelydra serpentina serpentina* and *Terrapene ornata ornata*) that certainly are indigenous even though they are as yet undocumented by specimens. Comment is made on the possibility that two additional genera, *Graptemys* and *Malaclemys*, both of which are represented in southern Texas, eventually may be found to occur in northeastern Mexico.

Other sections of the text include an informative preface and introduction, a gazetteer with subsections arranged in a variety of ways for easy reference, maps showing approximations of the ranges of the many kinds of turtles, and illustrations depicting about three-fourths of the species-group taxa. There is an index to the scientific names that appear in the synonymies and chresonymies, and a general subject index. An appendix, entitled "Bibliographic Addendum III" lists 767 papers that supplement the collectively lengthy bibliographies published in previous volumes of this great opus. To find most of the references listed in the text the reader must turn to earlier parts of the "Synopsis of the Herpetofauna of Mexico," an unavoidable inconvenience in view of the enormity of this massive, multi-volumed work. All papers are indicated by serial numbers, however, which facilitates locating them.

There are keys for the identification of families, genera, species, and subspecies. References to the many taxa, at all levels, are subdivided under a variety of headings. The first species to appear in the book, *Claudius angustatus*, may be used as an example to show the very wide range of subjects covered. First, there is a complete chresonymy and then the following subheads: Type, Type-locality, Content, Nomenclatural History, Literature, Diagnosis-Definition, Localities, Range, Etymology, Nomenclatural Status, Conservational Status, and Remarks. The subsection on Literature is subdivided into Comprehensive accounts, Popular literature, Habits in captivity, Mexican records, Belize records, Guatemala records, Anatomy, Hematology, Karyology, Parasites and diseases, Taxonomy, (additional) Literature surveys (presumably added after the main list had been completed), and illustrations. The subsection on Localities includes all known Mexican collecting sites by states, accompanied by the "acronyms" of museums in which specimens are represented, as well as references to papers in which specific localities are mentioned. The task of assembling and sorting all these data was obviously a colossal chore, even with computer help. This is especially true when it is considered that a great many of the species also range into the United States or Central America, and the literature for those areas was also sifted, although not in such depth, and incorporated into the appropriate portions of the text.

The information on the individual turtle species in this work, although much more detailed in many respects, is comparable with that appearing in the accounts of the Catalogue of North American Amphibians and Reptiles currently being published piecemeal by the Society for the Study of Amphibians and Reptiles. (This statement should not be construed, however, as a suggestion that future catalogue accounts for Mexican turtles be abandoned; their loose-leaf nature and individual small size make them highly useful, and they will provide an opportunity for updating the present opus as additional information accumulates.)

Unlike the "dry as dust" text of most reference works this one is delightfully leavened with an abundance of interesting and informative comments from Hobart Smith's vast store of knowledge. These range through a wide variety of topics, such as brief biographical sketches of some of the early naturalists, Baur and Berlandier for example, the squabbling of nineteenth century taxonomists about the proper names for various taxa, and the bizarre use of *Kinosternon herrerai* for the idiot tourist trade.

(I have personally seen, in shops both in Mexico City and Ciudad Juárez, large orchestras of these turtles dried and crudely positioned to resemble musicians performing on various instruments, an asinine practice reminiscent of the small stuffed alligators with electric light bulbs screwed into their mouths that once were vended as souvenirs in Florida.) There are also discussions of the peregrinations of the scientific names through veritable mazes of changes in the literature, cogent interpretations of the code of the International Commission on Zoological Nomenclature, numerous statements on derivations, endings, etc. for Latin and Greek words, and a profusion of similar items on a variety of subjects. To use a colloquialism, this book is a gold mine of information.

After becoming familiar with this huge work and the many subjects the authors have investigated in depth, it is difficult to select the most outstanding of its many contributions. Candidates, however, would include its up-to-date summary of all known turtle material from Mexico, greatly augmenting any previous compilation; the up-to-date review of the literature; the careful survey of nomenclatorial complexities, with attention directed to many overlooked actions in the past; and the section of the gazetteer devoted to the species recorded from each locality. Also, there is the intriguing innovation of using quadrants for locality listing, biogeographic analysis, and computer-based maps. These follow the index system of the American Geographical Society's Millionth Maps for Hispanic America by assigning numbers to each of the four quadrants surrounding the intersection of a line of latitude with a line of longitude. Any locality falling within the limits of any one of the quadrants is assigned to it, and by using this system, the distribution maps could be delineated by computer.

It is customarily the prerogative of a reviewer to make critical comments, but I shall keep mine few and brief, although in view of the several additional anticipated volumes in this master work, I do offer some constructive criticisms.

It is disappointing to find the term "lamina" used for certain of the epidermal, horny shields in spite of the recommendation of Zangerl that it should be avoided (Biology of the Reptilia, 1969, 1:315). The illustrations are the weak part of this otherwise extremely admirable work. The line drawings reproduced well, but the photographs fared rather poorly, presumably because of the type of paper used and the method of reproduction. Also, it is unfortunate

that the authors did not succeed in finding more pictures of living Mexican animals, a number of which were available, instead of depending in many cases on photographs of preserved specimens. These defects could be remedied in future volumes by using coated paper for printing the illustrations and by widely indicating well in advance the need for good photographs of live Mexican lizards, snakes, and amphibians.

The lack of diacritical marks is disconcerting, especially for a reviewer who has tried, in preparing his own manuscripts, to use with care the accent marks and tildes required by so many Mexican place names. A useful improvement would be to provide running heads by subjects. Inasmuch as the text pages are prepared in camera-ready condition, it would be a simple matter to put the names of the taxon under discussion at the top of each page. Because the word "Testudines" appears on all odd-numbered pages from 1 to 659, inclusive, browsing through this book or trying to find a reference without consulting the index or table of contents is frustrating.

A few words of praise should be directed to John Johnson, the publisher, for his success in making possible a modest price. Where else, in these days of inflation, could one expect to purchase a technical volume of more than a thousand pages for forty dollars? If it had been issued by one of the large commercial publishing houses, either in the United States or Europe, it conceivably could have cost triple or more that amount.

The Smiths, whom I have seen in action working on this stupendous project, certainly must rank among the most dedicated and industrious husband-and-wife teams in literary history. Their many friends and peers are unanimous in hoping they will remain in excellent health and a full state of vigor to complete their unprecedented self-assignment. Because Dr. Hobart Smith will retire in about two years from his academic and administrative duties, the pace at which the remaining volumes will appear should accelerate. When all the parts are finished, the "Synopsis of the Herpetofauna of Mexico" will stand as a monumental contribution of two extraordinary people. They will have created a superbly detailed compendium, the like of which does not exist for any other part of the world.

—Roger Conant, *Department of Biology, University of New Mexico, Albuquerque, N.M. 87131.*

NEWS & NOTES

BOOK REVIEW:

HANDBUCH DER TERRARIENKUNDE: TERRARIENTYPEN, TIERE, PFLANZEN, FUTTER. By Paul Heinrich Stettler. 1979. Stuttgart, Franckh. 228 pp., 142 figs. (color), softbound. DM 34 ($19.31, from Frankhsche Verlagshandlung, Kosmos-Verlag Abt. 15, Postfach 640, C 7000 Stuttgart 1, West Germany).

Nowhere in the world is private husbandry of amphibians and reptiles honed to higher professional standards than in Germany and Switzerland. The popularity of home terraria has led to a succession of exhaustively thorough handbooks, the most recent and in many ways the best of all being Stettler's beautifully and extensively illustrated, condensed but thorough treatment of the subject. The completely slick paper of this edition has permitted publication of one of the largest arrays (90) of superb color photos of amphibians and reptiles that has ever appeared. They constitute the chief value of the book for users unfamiliar with German, in which the entire text is written, but the investment is nevertheless thereby justified.

The other illustrations include 10 color photos of distinctive habitats in various parts of the world; 14 maps of seven biogeographic realms, a climatic and a vegetation-region map for each realm; and 25 line drawings and 2 black-and-white photos illustrating details of terraria, accessories and preservation techniques.

Seventy pages are devoted to a succinct review of the fundamentals of terrarium design, animal maintenance, and snakebite treatment, with considerable emphasis upon achievement of a natural-appearing habitat with use of plants appropriate to the animals maintained. The diagrams provide exceptional detail. There is a brief but thorough coverage of illnesses and treatment thereof, and an unusual section on preservation of reptiles and amphibians upon their death.

Most (124 pp.) of the rest of the book is devoted to a condensed review of plants and herbs most desirable for terraria, or most characteristic of the seven biogeographic realms around which the review is organized. For each realm, or major subdivision thereof, a list of characteristic plants is given, followed by a list of characteristic amphibians and reptiles. For each animal species at least the family, scientific name and distribution are given, and often also the habitat, habits, appearance and food.

For North America, for example, 18 species of amphibians and 39 (including subspecies) of reptiles are listed; 4 and 3 respectively are illustrated. For Mexico and Central America, 21 amphibian and 50 reptile species and subspecies are listed, 7 and 3 respectively illustrated. The emphasis throughout is upon exotic (to Europe) regions and biota, hence there is very little about Europe.

The Biogeographic section is followed by a list of addresses of commercial sources for equipment, plants and animals, and of terrarium societies. Six pages are devoted to a bibliography of terrarium-related literature, followed by 15 pages of a "systematic overview", summarizing plant and herpetological classification insofar as pertinent to terrarists. A quite thorough index to subject and to scientific names terminates the book.

The features that combine to make this work outstanding are the excellent illustrations, the biogeographic organization with emphasis upon the plants and habitats properly associated with representative herps, and the authoritative detail and thorough coverage compressed into so few pages. The result is a handbook of highest quality that does not exceed in size (approximately 15.5 x 23 x 13 cm) the expectation engendered by the name.

—Hobart M. Smith, *Department of Environmental, Population and Organismic Biology, University of Colorado, Boulder, Colorado, 80309.*

Received 15 July 1981

NEWS AND NOTES:

ANNOUNCING

the

INVENTORY OF LIVE REPTILES AND AMPHIBIANS

IN

NORTH AMERICAN COLLECTIONS. CURRENT JANUARY 1, 1981

by

Frank L. Slavens

This book contains approximately 200 pages of information compiled from 160 (70 public and 90 private) reptile and amphibian collections. Detailed information, such as the location and sex of all individual specimens of 1,244 forms of 927 species; a list of species bred during 1980; and miscellaneous breeding information (including dates of egg laying and hatching, types of incubation media used, and temperatures); is included. To order please fill out the form below and return it to: Frank L. Slavens, P.O. Box 30744, Seattle, Washington, 98103.

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NEWS AND NOTES:

Addenda

Vance, Thomas. 1980. A field key to the whiptail lizards (Genus *Cnemidophorus*). Part II: The whiptails of Mexico. Bull. Md. Herp. Soc. 16(9):121-147.

Page 138: fig. 8; *C. deppei deppei* should be illustrated as ranging from the Pacific versant of SW Michoacan southward to the Pacific versant of NW Costa Rica and on the Gulf of Mexico versant of SE Veracruz to W Campeche and on the Caribbean versant of N central Honduras.

NOTES

Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

Information for Authors

All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $6.00.

Reprints are available at $.03 a page and should be ordered when manuscripts are submitted or when proofs are returned. Minimum order is 100 reprints. Either edited manuscript or proof will be returned to author for approval or correction. The author will be responsible for all corrections to proof, and must return proof preferably within 7 days.

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DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

MDHS.......A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

DECEMBER 1981

VOLUME 17 NUMBER 4

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

Volume 17 Number 4 December 1981

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The Maryland Herpetological Society
Department of Herpetology
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BULLETIN OF THE

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The Maryland Herpetological Society

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Membership Rates

Full membership in the Maryland Herpetological Society is $12.50 per year, subscribing membership (outside a 20 mile radius of Baltimore City) $10.00 /year, Foreign $12.00/yr. Make all checks payable to the Natural History Society of Maryland, Inc.

Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May-August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

Bulletin of the Maryland Herpetological Society

Volume 17 31 December 1981 Number 4

Venomous Snakes of Southern Africa

W. R. Branch

3. Concluding Part: Colubridae

The Colubridae as traditionally understood, consists of a massive assemblage of more than 1500 species, double the number of species in any other reptile or amphibian family. It is not surprising therefore that there exists disagreement over the size and content of the family. This confusion stems in no small measure from the inordinate emphasis placed for years on snake fangs and their associated venom structures. Colubrid snakes were long grouped as much for the front fangs (erectile or fixed) they lacked, as any other features they shared. It is now evident that the evolution of fangs and associated venom delivery systems has strong selective advantages, and is therefore likely to have occurred independently in diverse snake groups. Back-fanged (Ophistoglyph) snakes are thus polyphyletic, and only recently have researchers looked at other features to determine their relationships.

The renaissance in Colubrid systematics has led to a plethora of differing views. Comparison of the recent familial arrangements of Bourgeois (1965), Underwood (1967, 1979) or Dowling and Duellman (1978) with the more traditional content of Boulenger's Catalogue of Snakes (1893) will exemplify this point. It is probably too optimistic to expect an imminent breakthrough in the analysis of the relationships of these snakes, but the application of a number of new approaches promises much. Increasingly such diverse techniques as electrophoresis, cytosystematics, microdermoglyphics, etc., are being used, while detailed analyses of internal anatomy, particularly of the skull, lungs, and hemipenes, give new insights almost daily. Soon it should be possible to synthesize these data, and with the aid of modern numerical techniques, arrive at a more rationalized concept of the group.

Venomous colubrids in southern Africa are numerous and diverse. Their clinical importance ranges from inconvenient to deadly; at least two have documented fatalities; bites from three others have been responsible for hospitalization with consequent mild to severe morbidity; while three to four other species have venoms that cause mild but discernable localized symptoms. All have enlarged fangs and associated Duvernoy's glands, and were previously placed in the subfamily of Boigninae or other families. Current taxonomic opinion would place them in three, possibly four, different colubrid subfamilies.

No key is presented to distinguish these snakes. All come from diverse groups, and no useful key could be devised to distinguish them from other closely-related, but harmless species. Clinically two points should be stressed. A) Only for the boomslang, *Dispholidus typus* , is there a specific antivenom. This offers no paraspecific cross-protection against snake bites from other back-fanged species. B) Side-stabbing snakes (*Atractaspis* - previously called mole or burrowing vipers) may be confused with true vipers - both possess erectile front fangs. They can be distinguished from true vipers by their long, thin, usually black bodies and typical colubrid head shields. Only the night adders *(Causus)* among viperids possess the latter, but have basically brown, patterned bodies. *Atractaspis* venoms are not neutralized by existing antivenoms, and so care should be taken not to confuse them with viperids.

SYSTEMATIC ACCOUNT

Family: Colubridae
Subfamily: Colubrinae
Tribe: Dispholidini

Dispholidus Duvernoy Boomslang

The genus is monotypic and in southern Africa unlikely to be confused with any other snake. It bears a strong external similarity, however, to the central and west African arboreal genus *Thrasops* (including *Rhamnophis* - considered by some authors to merit generic recognition). The similarity is so striking as to confuse even expert herpetologists, and indeed the 'new' subspecies *Thrasops jacksoni mossambicus* was based on a misidentified boomslang. Both genera are of similar build, size and colouration, although *Thrasops* does not develop the bright sexual dichromism of the male boomslang. Both inflate the neck region in threat. These similarities probably confer on *Thrasops* mimetic benefits, but the similar morphologies of the two genera are probably due to close evolutionary relationship and not convergence. This is supported by the congruence of their skull and hemipeneal morphology, features that would not be subject to mimetic convergence.

Bourgeois (1965) placed *Dispholidus, Thelotornis, Rhamnophis* (considered by her to be generically distinct) and *Thrasops* in a separate subfamily, Dispholidinae, due to shared osteological characters. This conflicts with Dowling's inclusion of *Thrasops* and *Rhamnophis* in a different tribe (Philothamnini) from *Dispholidus* and *Thelotornis* (Boigini) within the subfamily Colubrinae (Dowling and Duellman, 1978). Recently Underwood (1979) has placed all these genera into a subfamily Colubrinae - but one of greatly reduced content. The tribal concept recently redeveloped by Dowling (1974) and McDowell (Smith, *et. al.*, 1977) has much to recommend it. Perhaps the Dispholidinae of Bourgeois

should be incorporated as a separate tribe within the Colubrinae.

Long considered monotypic, a number of races of boomslang have recently been recognized (Laurent, 1955). Following an analysis of Central African material, Laurent (1955) revised the name *viridis* A. Smith, and described two new races - *kivuensis* and *punctatus*. It now seems that *viridis* is inseparable from typical *typus*. The other races have lower subcaudal counts than *typus*. Male *punctatus* are black with a yellow spot on each scale, while *kivuensis* males are green, with or without black scale edging. Only typical *typus* occurs in southern Africa.

Dispholidus typus typus (A. Smith) Boomslang (Fig. 1)

Identification:

The boomslang ranges through much of the Afro-Tropical region. Its common name in Afrikaans means simply 'tree snake'. Although non-specific, the choice is apt as the species is almost wholly arboreal, and the word has become adopted into general English usage. It is a large species, approaching 2 m in length, with a conspicuous short head and very large eyes. The body is covered in strongly-keeled, overlapping scales, that are arranged in marked diagonal rows, of which there are 17-21 (usually 19) at midbody. The tail is reasonably long (87-131 paired subcaudals) with an obvious hemipeneal bulge in adult males. There is little difference in scale counts between the sexes, the anal is divided, and there are from 167-200 ventrals.

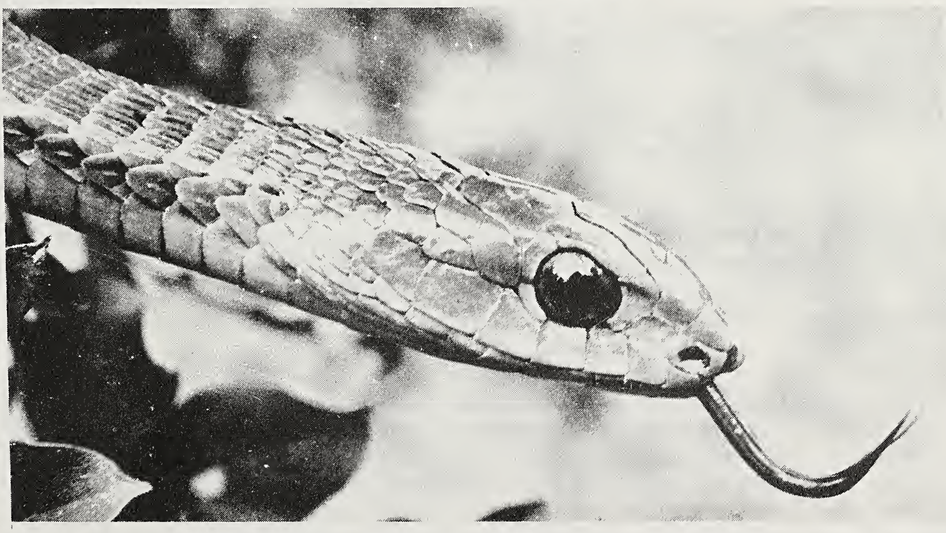

Figure 1. The boomslang (*Dispholidus typus typus*). Note the very large eyes. (Photograph by the author)

Colouration is very variable and complicated by the existence of sexual dichromism, ontogenic change and regional colour variants. Juveniles have a dorsal body colouration somewhat similar to that of *Thelotornis*, i.e., a fine stippling of browns and greys. The dorsum often bears small blue flecks (particularly anteriorly), and the intestitial skin in the neck region is yellow/orange. The pale belly is usually covered with black flecks. The conspicuous head is chocolate-brown above, immaculate white below, with a brilliant emerald eye. At approximately a metre in length the juvenile colouration changes gradually to that of the adult. Males are more vividly coloured than females, which are usually a uniform drab olive or brown. The male livery is bright green, while in thickly vegetated regions the body scales are often bordered in black to give a chequered or barred appearance. In some areas even brick red (e.g. Port Elizabeth) or black/yellow (southern and southwestern Cape) specimens can be found in conjunction with more normally-coloured individuals.

Distribution

Occurs over much of Southern Africa with the exception of montane grasslands, the central highveld, and the waterless wastes of the arid western regions and central Karoo.

Biology

Few herpetological sights compare with that of the boomslang gracefully gliding through bushes in search of food. The alert head is cocked and held motionless while lateral waves sweep the anterior body. The snake may freeze when prey is spotted, then slowly gather itself for a switft strike or pursuit through the foliage. The prey - usually chamaeleons, although birds particularly fledglings, small mammals, even frogs are also eaten - is held tightly in the jaws and no attempt is made to constrict. The large fangs are worked into the victim by a chewing motion, and it quickly succumbs to the potent venom.

All activities, e.g., feeding, basking, mating, etc., are performed aloft, although the snake will occasionally come to earth to cross clearings, and females often lay their eggs in rotting logs on the forest floor. As many as 25 white, elongate (40 x 20 mm) eggs may be laid and take 10-14 weeks to hatch.

The snake is notably unaggressive and was handled for many years before it was realized to be potentially dangerous. When first captured, it gives a characteristic threat, inflating the neck and forepart of the body. Due to its wide gape and relatively large back fangs, it can give an effective stab-bite, but serious envenomation usually requires the snake to chew for a few seconds. The venom is an extremely potent blood coagulant, and after a variable period that may last from 1-24 hours, leads to a progressive disseminated intravascular

coagulation, that may terminate in death. Viscous and produced in minute amounts (approximately 1 mg, but up to 17 mg may be milked from the glands of dead snakes), the venom has an LD_{50} in mice of 720 ng/kg. The factor responsible for the main coagulant activity is a thermolabile glycoprotein, with a molecular weight of from 55,000 to 67,000 (Hiestand and Hiestand, 1979).

A potent boomslang antivenom is available from the South African Institute of Medical Research, and is dramatically effective even 3 to 4 days after envenomation.

Thelotornis A. Smith — Vine, Twig, or Bird Snakes.

The taxonomy of *Thelotornis* has recently been reviewed by Broadley (1979). He recognizes 2 species: *kirtlandi*, a rainforest inhabitant found in Central and West Africa; *capensis*, a savanna species (which occasionally invades the forest periphery) that occurs from Central and East Africa southwards, entering the northern regions of southern Africa, but absent from the Cape Province and Orange Free State of South Africa. Three races of *capensis* are recognized, and all enter the area under discussion.

Key to tne races of *Thelotornis capensis*

1. Top of head uniform green or with black speckling; temporals usually with dark stippling . . . .*capensis mossambicanus*.

   Top of head blue-green, with black and pink speckling often restricted to a 'Y' shaped marking; temporals pink margined with black

2. Ventrals usually more than 162; top of head always blue-green with black and pink speckling restricted to a 'Y' shaped marking with its base along the parietal suture and the arms extending on to the supraoculars . . . . *capensis oatesii*.

   Ventrals usually less than 162; top of head with dark speckling extensive or restricted to a 'Y' shaped marking . . . . *capensis capensis*.

Thelotornis capensis capensis — Southern Vine Snake (Fig. 2)

Identification:

Once known, this snake can hardly be confused with any other species. Of moderate size, but very slender build, it is readily mistaken for a dead twig or vine. The head is long and lance-shaped, with a

large eye and characteristic keyhole-shaped pupil. The body scales are narrow, feebly-keeled and arranged in 19 oblique rows at midbody. Ventrals range from 144 to 162 with a clinal decrease in counts in southern populations. The anal is divided and the very long, slender tail has numerous paired sub-caudals (127-152). These may even exceed the ventrals in number. Due to its thinness, the tail is delicate, and almost 50% of individuals have truncated tails. Males on average have higher subcaudal counts, but lower ventral counts than females.

The body is ash-grey or grey-brown in colour with diagonal bands of pale blotches and flecks of black, pink and/or orange. One or two black blotches occur on the sides of the neck, while the belly is pink-grey with numerous dark grey blotches. The top of the head is blue-green and usually heavily speckled with black and some pink. A 'Y'-shaped concentration of speckles may occur along the parietal suture and supraoculars, but may be obliterated by other speckling. The temporal scales are usually pink, margined with black. Juveniles often have poorly-developed head markings. The chin and lower labials are white, speckled with black. There is no sexual dichromism.

This is the smallest race, and averages 600-800 mm in snout-vent length.

Distribution:

A southern race, extending from southern Natal, through the eastern and northern Transvaal, Swaziland, and eastern Botswana, to intergrade with *oatesii* in Zimbabwe, and *mossambicanus* in Mocambique.

Figure 2. The southern vine snake (*Thelotornis capensis capensis*). Note the long head and keyhole-shaped pupil of the eye. (Photograph by the author)

Biology:

The vine snake ambushes its prey, relying on its cryptic colouration and twig-thin body to escape detection. Potential food coming close to the snake is carefully stalked, the long body inching slowly towards the prey. Although lizards, particularly chamaeleons, form a major part of the diet, fledgling birds, small mammals (including bats), and even other snakes are eaten. It has been suggested that the bright red and black tongue may be used to lure birds. Indeed the generic name *Thelotornis* may even mean "bird-charmer" (Goodman and Goodman, 1976 a). The inflated neck of the threat posture also gives the vine snake a striking resemblance to a fledgling bird, and this may confuse parent birds, tempting them to fly too close and render them vulnerable to predation (Goodman and Goodman, 1976 b). When caught, the prey is held fast and the snake's jaws rapidly chew backwards and forwards to inject venom. No attempt is made at constriction. On death, the prey is consumed, usually as the snake hangs down headfirst from the branches.

Up to 13 small, elongate eggs (34-38 x 14-18 mm) are laid in mid-summer, and take about 3 months to hatch.

Like the boomslang, the toxicity of vine snake venom was not appreciated until many years after the discovery of the snake. It was not until 1958 that the first recorded fatality occurred (FitzSimons and Smith, 1958).

Several more fatalities have been subsequently recorded, including that of the famous herpetologist Robert Mertens in 1975.

Due to the confused taxonomic history of *Thelotornis*, a number of case histories attributed to *T. kirtlandii* are now known to be due to *T. capensis*. The first case from Tanzania described by FitzSimons and Smith (1958) was due to *T.c. mossambicanus;* the second case (FitzSimons and Smith, 1958) and that of Blaylock (1960) was caused by *T.c. oatesii;* while the recent non-fatal case of Atkinson *et. al.* (1980) was from *T.c. capensis*. The similar aeitiology of all these cases suggests that the venom of all three races is identical in composition and toxicity.

The venom, like that of the boomslang, causes a consumptive coagulopathy, and appears to have the same mechanism of action, being able to activate prothrombin and Factor X (Atkinson, *et.al.*, 1980). It is also a single-chain polypeptide, containing one or more interchain disulphide bonds, and with a molecular weight around 55,000. Despite these similarities, it is not neutralized by specific boomslang antivenom or polyvalent SAIMR antivenom. Bites should be treated systematically with transfusions of platelets and fresh plasma.

Thelotornis capensis oatesii (Gunther) Oates Vine Snake (Fig. 3)

Identification:

Distinguished from the typical race by its higher ventral counts (158-177). The top of the head is blue-green with coarse pink and black speckling that is restricted to a 'Y'-shaped marking. It is the largest race, usually with a snout-vent length of 700-900 mm, and exceptionally reaching 1050 mm.

Distribution:

Found in Namibia, northern Botswana and most of Zimbabwe, intergrading with *mossambicanus* along the eastern highlands of Zimbabwe, and with typical *capensis* in southern Zimbabwe. Extra-limitally it extends through Angola and Zaire to Lake Malawi.

Biology:

As for the typical race. It may be found in moist miombo woodlands and riparian forest, as well as dry savanna with mopane and acacia trees (Broadley, 1979).

Figure 3. Oates vine snake (*Thelotornis capensis oatesii*) in threatening posture, with the head held erect and the throat region partially inflated. (Photograph by the author)

Thelotornis capensis mossambicanus (Bocage) Mocambique Vine Snake

Identification:

A slender race, having scutellation similar to *capensis* but characteristically having a uniform green head, sometimes with scattered black speckling that may also extend onto the temporals. Usually with a snout-vent length of 650-850 mm, it does not exceed 950 mm.

Distribution:

Mocambique, intergrading with *capensis* in Zululand and southern Mocambique, and with *oatesii* in the Zimbabwe eastern highlands. Extra-limitally it extends along the east coast of Africa to Kenya and Somalia, reaching inland as far as Lake Tanganyika.

Biology:

As for the other races, but inhabiting moist savanna and evergreen forest.

Subfamily: Aparallactinae

These peculiar African colubrids form a discreet group of basically fossorial or semi-fossorial snakes. Many are specialist feeders, most taking various burrowing reptiles, particularly amphisbaenians, some taking invertebrates, e.g., centipedes. They lack apical scale pits and a loreal scale, and their hemipenes have a centripetal sulcus. All of these are unusual colubrid features. Their relationship to elapids which also share these features, is intriguing. Bogert (1940) notes that posterior hypopophyses are absent in some aparallactines (his Group VII), but present in natricines and elapids. They are present, but greatly reduced in *Atractaspis*. McDowell (1968) suggests that *Elaps*, the type genus of the Elapidae, is not an elapid, but rather has aparallactine colubrid affinities. Similarly, Borgeouis (1965) and Branch (1981) have shown that *Atractaspis* is not a viperid, but again has aparallactine colubrid affinities. If these genera are included in the Aparallactinae, the detitional phenomena in this one subfamily ranges from aglyphous (*Aparallactuc modestus*) to clinically important opisthoglyph (*Macrelaps microlepidotus*), proteroglyph (*Homoroselaps lacteus*), and solenoglyph (*Atractaspis microlepidota*) species. It should serve as the 'death knell' of classifications based solely on fangs.

Macrelaps microlepidotus (Gunther) Natal Black Snake (Fig. 4)

Identification:

A medium-sized burrowing snake, with a stout body, small head and minute eyes. The body scales are in 23-27 rows at midbody, and smooth except in the cloacal region where they are faintly keeled. Small white supracaudal tubercules have been reported in males, possibly associated with breeding. The shortish tail bears 35-50 unpaired subcaudals, with little indication of sexual dimorphism in counts. As in other aparallactines (but unusual for most other colubrids) there is no loreal scale or even a preocular. The prominent enlarged fang is preceeded by 4 smaller teeth and sits on the maxilla adjacent to the rear margin of the eye. Body colouration is a uniform black or dark grey, slightly lighter on the ventral surface of some individuals. Adults average 600-900 mm but may exceptionally exceed 1 metre in length.

Distribution:

Extending along the east coast of southern Africa from Zululand to East London, usually in association with riverine forest. There is a record from the forest at Katberg in the eastern Cape Province, South Africa, but this has not been confirmed in recent years. Much of the indigenous forest in this region has been removed, and suitable habitat for the species must now be restricted or absent. The species has not yet been recorded from the southern Mozambique flood plain.

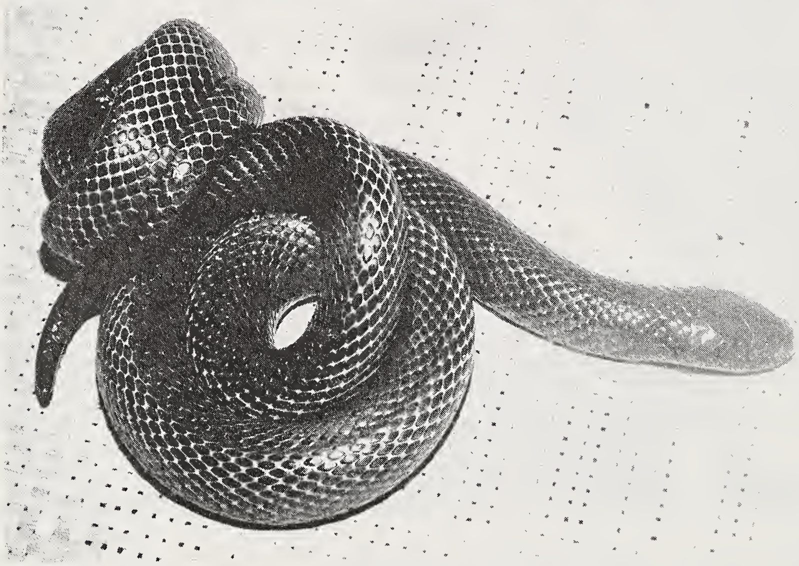

Figure 4. The Natal black snake (*Macrelaps microlepidotus*). (Photograph by the author)

Biology:

Little is known of this cryptic species, save that it appears to prefer damp situations, and has occasionally been observed swimming in forest streams. It does not seem to be restricted to an amphibian diet, however, and in captivity readily takes small mammals and even other snakes. Like all aparallactines it is oviparous, laying up to 10 eggs in summer. The white eggs are largish (38-56 x 23-28 mm) and take 65-70 days to hatch. The young measure up to 290 mm in length.

Often relatively docile when handled, it may still bite suddenly, even after having been in captivity for a long period. The potential danger of this species is still problematic. FitzSimons (1919, 1929) treated it as harmless, but later his two sons noted cases of severe symptoms following bites by *Macrelaps* (FitzSimons and Smith, 1958; FitzSimons, 1962). Exasperatingly they gave no further details. This frustrating situation continues. Chapman (1958) recorded a single case in his extensive Natal snakebite survey. It caused only slight local pain and swelling. This conflicts with the later observation of "Complete loss of consciousness and collapse for up to thirty minutes has resulted in the two instances recorded when the species has inflicted a bite" (Visser and Chapman, 1978). The topic requires investigation.

Homoroselaps Jan — Dwarf Garter Snakes

These small, colourful snakes were for long considered to be elapids. McDowell (1968) demonstrated that they shared many characteristics with aparallactine colubrids, particularly the genera *Polemon* and *Chilorhinophis*. Their removal from the Elapidae causes nomenclatural problems as *Elaps*, the species correct generic name, is the type genus of the family. McDowell (1968) has recommended adoption of the junior synonym *Homoroselaps* Jan to avoid unnecessary disruption of well-known existing names.

Key to the species of *Homoroselaps*

Ventrals 160-215; moderately stout in build; variously marked with yellow or red on a black background . . . . *lacteus*

Ventrals 215-240; very slender in build; black above with a single, well-defined yellow vertebral stripe from the tip of the snout to the end of tail . . . . *dorsalis*

Homoroselaps lacteus (Linnaeus) Spotted Dwarf Garter Snake (Fig. 5)

Identification:

The snake has a blunt rounded snout, with a relatively small eye. The smooth body scales are in 15 rows at midbody, and there is a well defined sexual dimorphism in scale counts: ventrals, 160-190 (average 175) in males and 184-209 (average 197) in females; subcaudals, 34-41 (average 38) in males and 25-33 (average 30) in females.

Colouration is very variable, and a number of colour varieties may be distinguished: Variety 1 - Common in the Eastern Cape. Yellowish-white above with 30-50 transverse black bars on the body and 4-5 on the tail; the bars may be disrupted and equal or unequal in width to the white interspaces; a bright orange-yellow to orange vertebral streak usually runs from the back of the head to the end of the tail; the head is black above and on the sides, except for the 1st and 2nd (or 1st only) and 4th and 5th (or 5th only) upper labials, which are yellowish white. Below, yellowish white, with or without a continuous or interrupted median black stripe, or sometimes uniformly black; when underparts are pale, the dark bars of back obtrude on to the sides of the belly and completely encircle the tail, and conversely when underparts are black, the pale interspaces of back do likewise.

Variety 2 - Above, black, with irregular yellowish white crossbars or interspaces and a vertebral series of orange to red spots which are usually more or less confluent into a streak from head to tail; reticulate markings of red and yellow along the sides. Head black, with individual shields spotted in varying degree with yellow. Below, ventrals and subcaudals black at base and yellow behind, giving thus a barred effect; chin and throat pale with scales dark-edged in varying degrees.

Variety 3 - Above, black, with each scale bearing a yellow dot and a bright orange yellow vertebral streak from back of head to end of tail; on sides of body the three outer rows of scales are yellow with a narrow black edging. Head black, each shield bearing a yellow spot of variable size. Below yellow, ventrals black or dark brown at base.

It usually reaches a length of 300-400 mm but large specimens of nearly 600 mm have occasionally been found.

Distribution:

Throughout the coastal areas of the Cape Province from Namaqualand to Natal, entering the eastern Orange Free State, Transvaal, Swaziland and Lesotho.

Figure 5. The spotted dwarf garter snake (*Homoroselaps lacteus*); colour variety 1. (Photograph by the author)

Biology:

A semi-fossorial species, often found under stones on sandy soil and in old termite nests. It feeds on other small reptiles including worm snakes (*Leptotyphlops*), blind snakes (*Typhlops*), slug eaters (*Duberria lutrix*), and fossorial skinks (*Scelotes* and *Acontias*). Up to 6 small eggs are laid in midsummer.

When captured, the snake rarely bites, but often wriggles violently. Few case histories have been recorded. In one, a young boy was bitten on the webbing between the thumb and fore-finger by a garter snake of 250 mm length. The snake hung on for a few seconds before being removed. There was immediate pain at the bite-site with progressive swelling involving the thumb, fore-finger and palm of the hand. The swelling did not begin to decrease until day 3, and the patient was only released from hospital on the fifth day, still experiencing pain. Antivenom was injected subcutaneously at various sites in the bitten limb, but did not appear to give relief. (J. Marais pers. comm.)

Homoroselaps dorsalis (A. Smith) Striped Dwarf Garter Snake

Identification:

One of the smallest snakes in southern Africa (excluding *Leptotyphlops*). It rarely exceeds 300 mm, and is also of very slender build. The smooth body scales are in 15 rows at midbody. Ventrals are numerous (215-239) and rarely exceed 220 in males, or are less than 225 in females. The anal is entire, and the paired subcaudals also show sexual dimorphism, i.e., 29 or over in males, less than 27 in females. The body is black with a conspicuous yellow vertebral stripe extending the length of the snake. The anterior belly, adjacent scale rows, chin and throat are pale yellow. The posterior part of the body and underside of tail are chrome yellow.

Distribution:

Found in the northern regions of South Africa from the Transvaal, southwards into Natal and central Orange Free State.

Biology:

A very rare snake and details of reproduction, feeding, etc., are unknown. Due to its very small gape, it is unlikely to be a danger to man. There are no recorded bites.

Atractaspis (A. Smith) Side-Stabbing Snakes

As has been noted earlier in this series (Branch, 1978), these peculiar burrowing snakes, previously called mole-vipers, are not now considered to be viperids (Bourgeois, 1965; Branch, 1981). Their erectile front fangs represent an interesting case of parallel evolution to the condition found in viperids. Because of their unusual ability to erect a single fang without opening the lower jaw, the descriptive and more appropriate name of side-stabbing snake has been proposed (Branch, 1978).

These snakes share many similarities with aparallactive colubrids, but also possess major differences, including the osteological features associated with the erectile fangs, the development of the venom glands, and the retention of posterior hypopophyses (albeit greatly reduced). Placing them in a separate monotypic subfamily within the Colubridae obscures their relationship to aparallactines. They are perhaps best placed in a separate tribe within the Aparallactine.

The genus was reviewed by Laurent (1950) who recognized 12 species and 32 races. Others have been subsequently described. It is

possible that a modern revision of the genus will reduce the number of accepted taxa. Only a single species occurs in southern Africa.

Atractaspis bibroni (A. Smith) Bibron's side-stabbing snake (Fig. 6)

Identification:

A small snake with a slender body and flat head that is not distinct from the neck. The eyes are small with round pupils and the scales are smooth and in 21-23 rows at midbody. Ventrals range from 196-260, with little differences between the sexes. The anal is entire, and followed by unpaired subcaudals, that are more numerous in males (21-27) than in females (18-25). The short tail ends in a spine.

Like most other members of the genus, the snake is a uniform purple-brown to black above, with a belly that may be uniform brown to black, uniform white, or mottled with brown and white. Usually 350-450 mm in length, they may exceptionally exceed 600 mm.

Distribution:

Extending through Natal and Transvaal into Zimbabwe, and further north to southern Kenya. It also occurs widely in Botswana and Namibia, but is absent from very arid regions. It enters the Northern Cape Province around Kimberley, and there is a recent record from Colesberg that may represent a relict population.

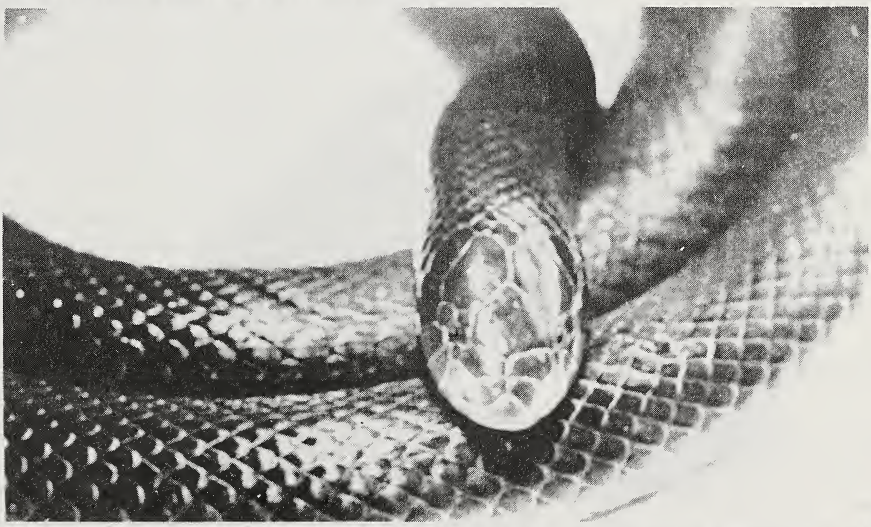

Figure 6. Bibron's side-stabbing snake (*Atractaspis bibroni*), showing the strong morphological similarity between this genus and that of other aparallactine colubrids, e.g., *Macrelaps*. Note the absence of the loreal scale. (Photograph by the author)

Biology:

A burrowing species that is usually found under stones, rotting logs or in old termite nests. It feeds on a wide variety of prey, including other burrowing reptiles (particularly *Typhlops*), and small mammals. Many lizards are also eaten, and these are probably caught by the snake as they sleep in their burrows at night. The unusual cranial kinesis, that allows the long fangs to be erected independently by compressing the slender lower jaw, is probably an adaptation to the envenomation of prey within the confines of burrows. The snakes may frequent well established burrows, and be found lying in shallow chambers under flat stones, where they derive heat from the sun-warmed rock. In captivity they can occasionally be observed excavating a chamber by hooking the earth out from under a stone, using the side of the head as a scoop. Up to six elongate (35 x 12 mm) eggs are laid in midsummer.

Due to its similarity to a number of harmless species, e.g., Cape Wolf Snake (*Lycophidion capense*) or Purple-gloss snake (*Amblyodipsas concolor)*, the snake is often mistakenly handled by herpetologists. Bites on the hands are thus frequent. In some regions, e.g. Zululand, *Atractaspis* bites may exceed those of such common species as the puff-adder (*Bitis arietans*). Most occur at night when the snake enters the huts of sleeping Zulus, or is trodden on as it moves around the surface on damp nights. Fortunately, bites result in little direct morbidity, and fatalities are unknown. Symptoms are characterized by initial intense pain, local swelling (see Fig. 7), sometimes with associated small

Figure 7. Localized swelling 24 hours after a bite to the affected finger by Bibron's side-stabbing snake (*Atractaspis bibroni).* (Photograph by C. Tilbury)

blood blisters, and lymphadenitis. Unless compounded by tourniquets or incision, necrosis is rare. Polyvalent antivenom is ineffective as it does not cross-react with *Atractaspis* venoms. Electrophoretically the venom behaves more like viperid venoms than elapid venoms, migrating toward the anode at pH 8.6. Venom yields range from 1.2-7.4 (average 4.2) mg of wet venom.

Other Southern African colubrids with mild venoms

A number of colubrids in southern Africa have been responsible for mild envenomation, but in no cases have symptoms approached clinical importance. In view, however, of recent overseas experience of severe symptoms developing after bites from generally accepted "harmless" colubrids (see Minton, 1978, for a review), it is stressed that these snakes should be treated with caution. All venoms are, at the least, foreign proteins and can possibly illicit sensitization with potentially harmful immunological sequelae in future bites. The actual toxicities of most colubrid venoms are unknown, but some indication of potential severity can be gauged from their effectiveness in killing prey items. Although venoms are known to have different toxicities in different animals, rapid death in mammalian prey following a bite should be taken as a warning of possible danger to man. Currently our knowledge of the potential toxicity of colubrid venoms originates, in nearly all instances, from case histories of bites to careless herpetologists from their captives. This is to be expected as to achieve envenomation, these snakes have to be handled, often roughly as they are behaviorally non-aggressive, and to have time to "chew" as their fangs are situated at the rear of the mouth, and are not cannulated as in viperids or elapids. The resultant 'illegal' bites may be considered almost as experimental data, and the natural epidemiological risk from these snakes to the population at large is almost negligible.

It is often difficult to differentiate between primary symptoms attributable to the direct action of the venom components, and immunological responses in sensitized patients. It is in herpetologists that the likelihood of multiple bites is greatest.

Amplorhinus multimaculatus (A. Smith) Cape Many-spotted Snake (Fig. 8)

This small, montane snake is of problematic taxonomic affinities and may be related to natricine snakes. It reaches a length of approximately 700 mm and feeds mainly on amphibians, although small mice and lizards may be taken. It is viviparous and gives birth to 4-8 young, up to 200 mm in length. Restricted to damp, marshy situations, often on mountin slopes, it occurs in the eastern regions of southern Africa from Cape Town to Inyanga, Zimbabwe. Its distribution is almost identical to that of the berg adder *Bitis atropos*.

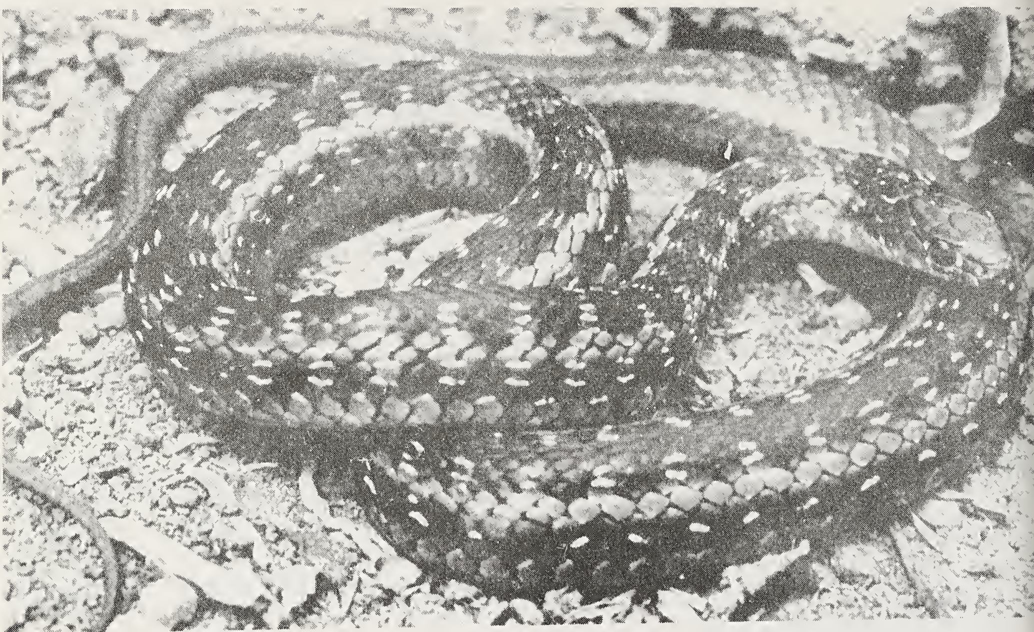

Figure 8. The Cape many-spotted snake (*Amplorhinus multimaculatus*). (Photograph by the author)

The only recorded bite (Blake, 1960) produced local symptoms of pain, inflammation and slight swelling, that resolved within a short time. The bite also bled freely at first, but did not develop severe hemmorrhages. Natricines are poorly represented in Africa, with only two monotypic genera (*Afronatrix* and *Hydraethiops*) in central and west Africa. Bites from these species are unknown, but those recorded for two species of the Asian natricine genus *Rhabdophis* have involved serious hematological abnormalities, that resulted in the death of one patient (Mittleman and Goris, 1974, 1978; Mather, *et al*, 1978).

Psammophis and related genera

Sand snakes (*Psammophis* and related genera) are common throughout much of Africa, and several species also enter Europe, the Near East and even Madagascar. Their taxonomic affinities remain debatable, and they may be related to colubrines (Underwood, 1979) or lycodontines (Dowling and Duellman, 1978). Their unusual 'vestigial' hemipenes give little

insight into their relationships, but their increased chromosomal number and morphology suggest lycodontine rather than colubrine affinities (Branch, unpublished observations).

It has been known for many years that some psammophines have toxic venoms. The common Afrikaans name for *Psammophylax rhombeatus*, i.e., skaapsteker, alludes to its presumed habit of biting sheep. With its small gape and small back fangs, however, it could hardly give an effective bite to such a large animal.

Two species of *Psammophylax* occur in southern Africa, and the genus has recently been reviewed by Broadley (1976). The spotted skaapsteker, *P. rhombeatus* (Fig. 9) extends through most of South Africa in savanna situations, and is known from scattered localities in Namibia. A distinct race *P.r. ocellatus* occurs in southern Angola. The striped skaapsteker, *P. tritaeniatus* extends from the northern regions of South Africa, through Botswana, Namibia and Zimbabwe, extending extralimitally to southern Angola and southeastern Zaire and southern Tanzania. Specimens from Natal are now known to be attributable to the striped form of *P.r. rhombeatus*. A third species, *variablis*, with 3 races, occurs in the montane grasslands from Malawi to Ethiopia. All the species are small to medium-sized (maximum length 1.5 m), diurnal foragers, that take a wide range of prey. Except for *P.v. variablis*, all forms are oviparous; *rhombeatus* laying up to 30 eggs measuring up to 35 x 18 mm; *tritaeniatus* laying from 5-18 eggs up to 25 x 12 mm. Both the latter, however, have been observed to occasionally coil around their eggs, which may be partly incubated when deposited. *P.v. variablis* may extend this reproductive strategy further and become ovo-viviparous, retaining the eggs until nearly ready to be born.

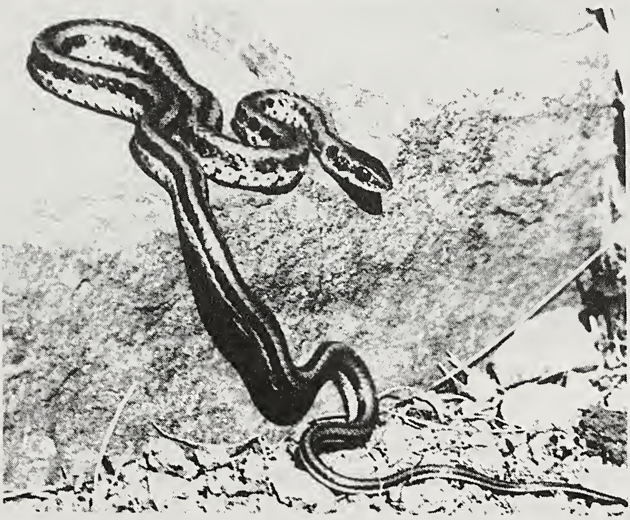

Figure 9. The spotted skaapsteker (*Psammophylax rhombeatus*). (Photograph by the author)

In 1919 F. W. FitzSimons reported some crude experiments that indicated that *Psammophylax rhombeatus* had a toxic venom, possibly neurotoxic in nature. He allowed skaapstekers to bite bare patches on the legs of 11 chickens and noted that three died within 10-360 minutes. In one fowl that did not die, the bite site turned greenish/yellow and the whole limb was swollen. In a later publication FitzSimons (1929) recorded that "skaapsteker venom is both a nerve and a blood poison. The symptoms are giddiness, lassitude, cold clammy skin and cold sweat on the forehead. A little swelling occurs at the site of the fang punctures, with discolouration of the surrounding tissues." These presumably describe symptoms occuring in humans. However, his basis for these observations and others, including that weight for weight, skaapsteker venom was "more poisonous than those of the dreaded cobra or mamba", remains obscure. In none of his scientific publications did FitzSimons give fuller details, and many of his observations were subjective and based on badly-designed, uncontrolled experiments. The subject requires modern analysis. Chapman (1968) observed "a slight local reaction of bruising and swelling, one with a rigor" in 3 *Psammophylax* bites in Natal, and similar symptoms were observed following a bite from an East Cape specimen (Fig. 10).

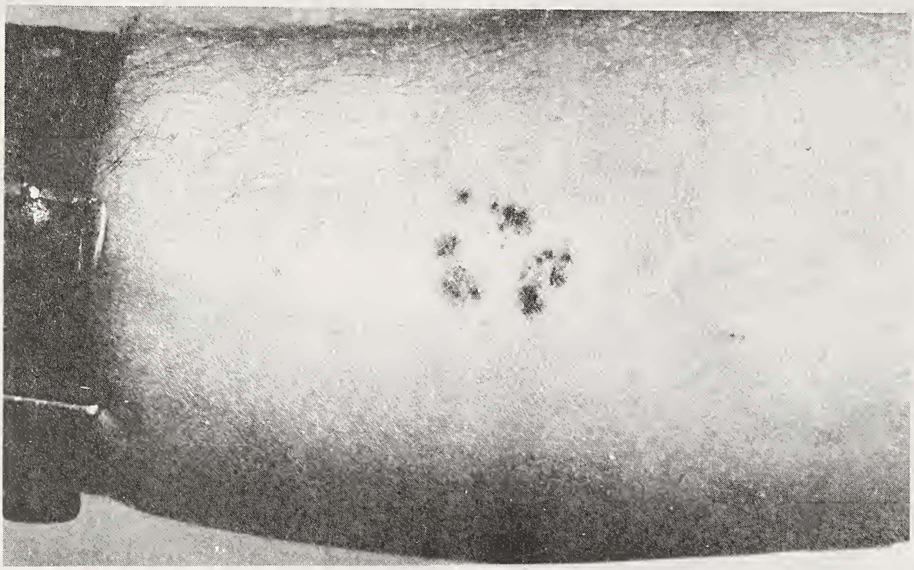

Figure 10. Localized symptoms at the fang puncture sites 48 hours after a spotted skaapsteker (*Psammophylax rhombeatus*) had "chewed" the affected area for several seconds. (Photograph by A. Batchelor)

The large sandsnakes (*Psammophis*) of southern Africa can give a quick and painful bite. Their taxonomy has recently been reviewed by Broadley (1977), who has shown that the large eastern form previously called *P. sibilans* (which may exceed 2 m in length) should be correctly called *P. phillipsii*. Typical *P.s. sibilans* is restricted to north Africa, being represented in southern Africa by a small race, *P.s. brevirostris* (Fig. 11). Confusion now exists in the literature concerning the species responsible for published bites. Following bites from Zimbabwe *P. phillipsii*, Broadley and Cock (1975) noted only local pain and inflammation, that usually disappeared within an hour, although slight swelling occasionally persisted for 24 hours. FitzSimons (1962) records more extensive symptoms of "severe pain, swelling, cold shivers and nausea lasting for several days". Detailed documentation, however, is lacking, and the species responsible (i.e., *phillipsii* or *sibilans)* is now unknown.

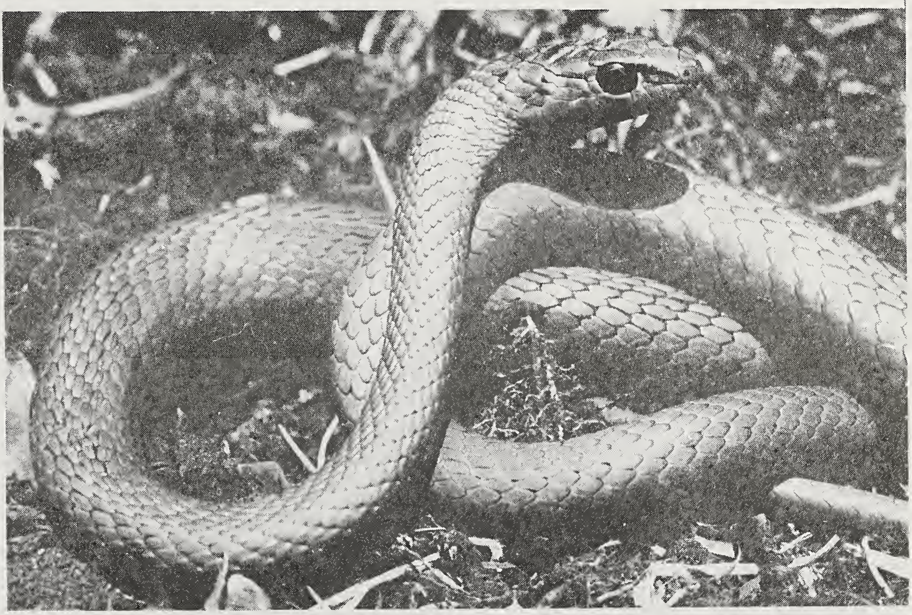

Figure 11. The short-snouted sand snake (*Psammophis sibilans brevirostris*). (Photograph by the author)

That serious symptoms may exceptionally occur from psammophine bites is suggested by recent experience with the European species *Malpolon monspessulanus*. This large psammophine, which like *P.*

phillipsii, may exceed 2 m in length, has a venom that quickly subdues mammalian prey, but which in man was considered to cause only slight pain and swelling. Recently, however, Gonzales (1979) records 10 cases of envenomation in Spain. Nine cases had local symptoms of oedma, parasthesia around the bite area and lymphangitis. A more severe case involved ptosis and difficulties in swallowing and respiration. The patient was treated with antihistamines and corticosteroids, and the symptoms disappeared in 48 hours.

Spawls (1979) records mild hemorrhagic symptoms following envenomation from a smaller species, *Psammophis biseriatus*. The snake managed to chew on his finger for 10 seconds before being extricated from a thorn bush, and therefore had ample time to engage its back fangs. The fang marks bled for some time after the bite, and the finger became very swollen with purple discoloration around the puncture. This was accompanied by lymphadenitis. Symptoms slowly resolved over 24 hours.

Other genera

Bites from a number of other small species having back fangs have been noted to result in minor localized symptoms of swelling and minor pain at the bite site. These include the Tiger snake (*Telescopus semiannulatus*) (Fig. 12), the red-lipped or Herald snake (*Crotaphopeltis hotamboeia*) and the marbled tree snake (*Dipsadoboa aulicus*). All are closely related and placed in the tribe Boigini of the Colubrinae (Dowling and Duellman, 1978).

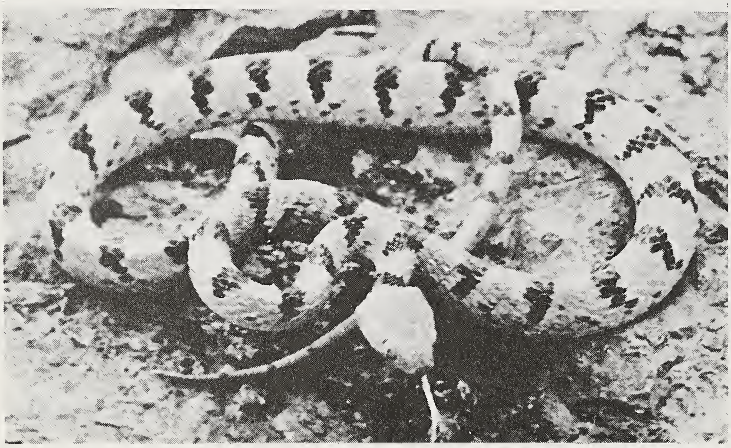

Figure 12. The tiger snake (*Telescopus semiannulatus*). (Photograph by the author)

Extralimitally a number of other colubrines have been reported to have toxic venoms. Mamonov (1977) noted swelling, pain and bleeding in 4 bites from the mountain racer (*Coluber ravergieri*) in Russia. Pain and swelling took 2-3 days to resolve. Milder symptons were experienced following a bite from *Coluber rhodorhachis* from Saudi Arabia (Branch, unpublished observations).

Besides these venomous species, bites from all snakes cause physical damage, which from large species such as the mole snake (*Pseudaspis cana*) may require sutures. An attendant risk of infection is always present. Finally, at least one species in southern Africa - the rock python (*Python sebae*) grows big enough (up to 6 m) to consider small humans edible, and a recent well-documented fatality due to this snake is known (Branch and Haacke, 1980).

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SATURDAY MARCH 20th 1982

MARYLAND SCIENCE CENTER
LIGHT St. & KEY HIGHWAY
at the INNER HARBOR

REGISTRATION & REFRESHMENTS 10:00 -11:00

FOR MORE INFORMATION CONTACT:

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